THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LX. No. 1536.] LONDON, OCTOBER 18, 1892. [44TH YEAR. PRICE 6d.

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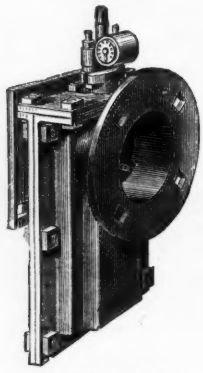

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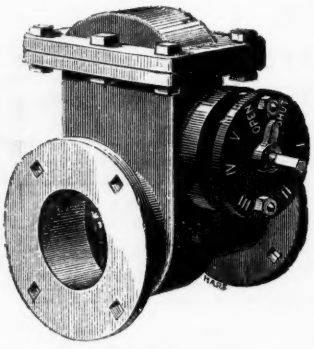

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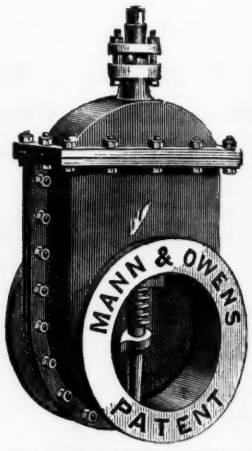

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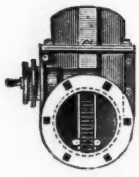

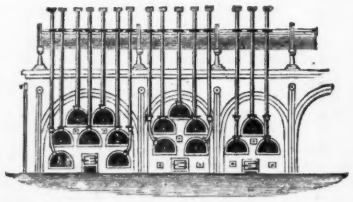

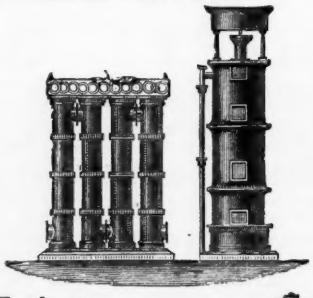

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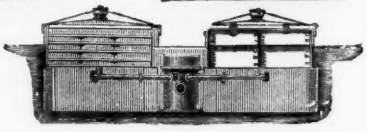

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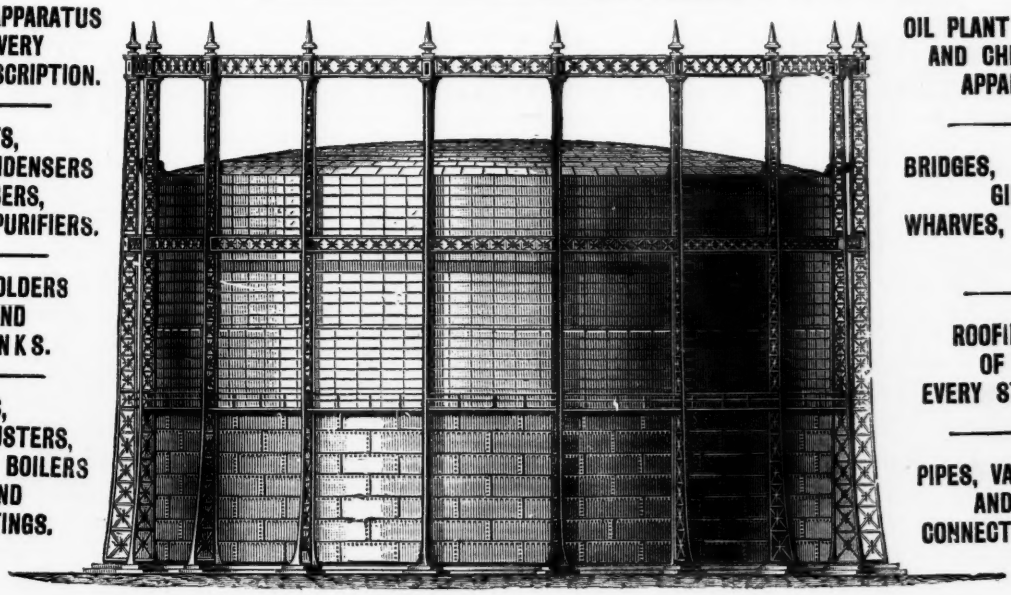

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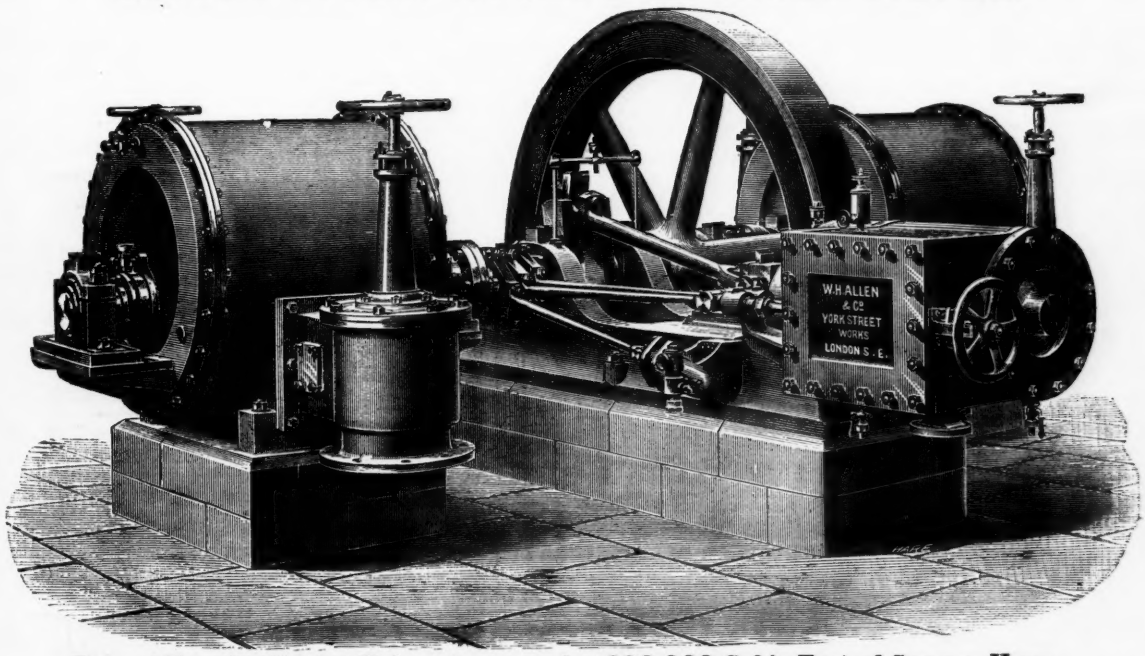

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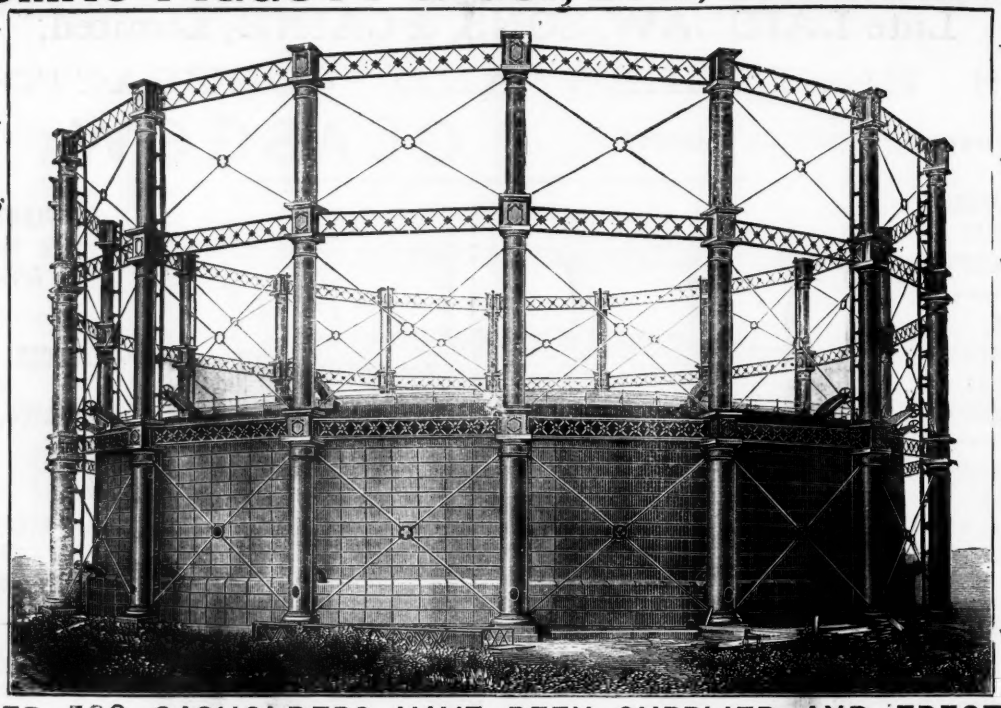

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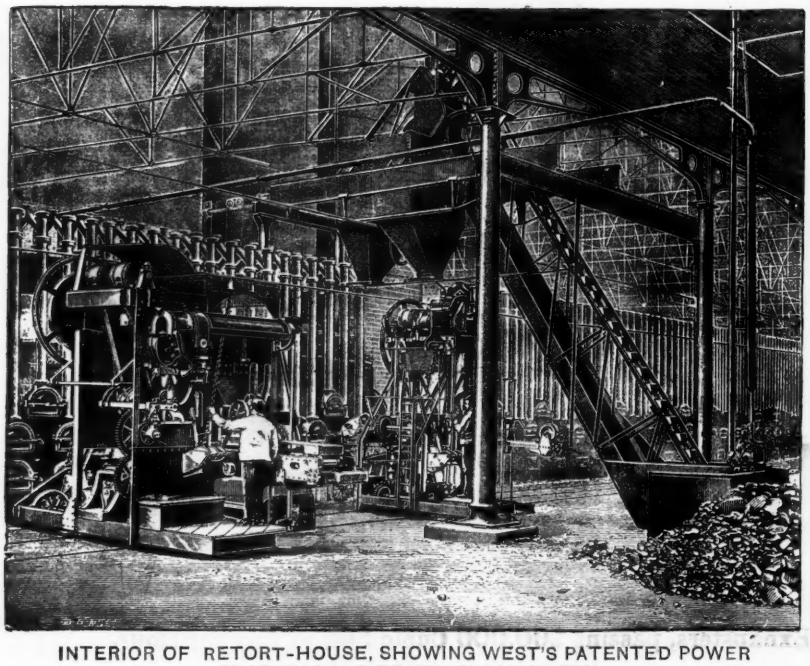

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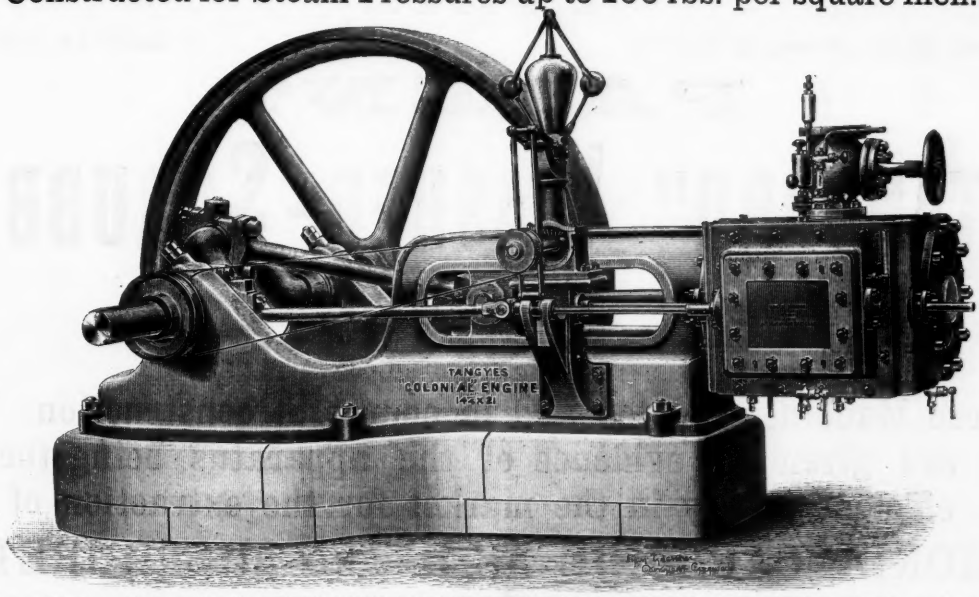
Constructed for Steam Pressures up to 100 lbs. per square inch.



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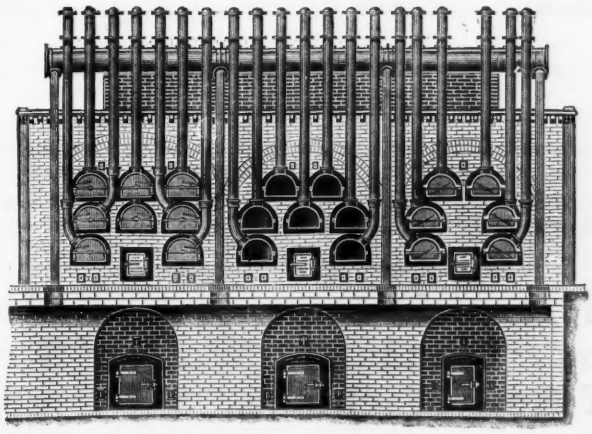

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PATENT

"STANDARD" WASHER-SCRUBBER.

455

of these Machines erected and in course of construction. These facts are given as evidence of the apparatus being the most efficient of any in the market for the extraction of

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Gentlemen,

In reply to your inquiry respecting the result of putting Wooden "Bundles" into some of the Washer-Scrubbers at our Beckton Station, I beg to say they have answered admirably for the few months they have been in; and I think them a decided success.

I am, yours truly,
(Signed) G. C. TREWBY.

NOTE.—Orders since received for two 3,000,000 cubic feet per day Machines for Kensal Green; and two 3,500,000 cubic feet for Beckton, &c., &c.

Extract from the JOURNAL OF GAS LIGHTING, &c., for Sept. 27, 1892, referring to the visit of the Members of the Eastern Counties Gas Managers' Association to the Lowestoft Gas-Works—

"Mr. J. Ayris has one of Messrs. Kirkham, Hulett, and Chandler's "Standard" Washer-Scrubbers in operation (capable of dealing with 500,000 cubic feet of gas per 24 hours); and of the working of this machine he spoke very highly."

Estimates furnished for cost of altering original pattern Patent "Standard" Washer-Scrubbers, or for the supply of New Machines.

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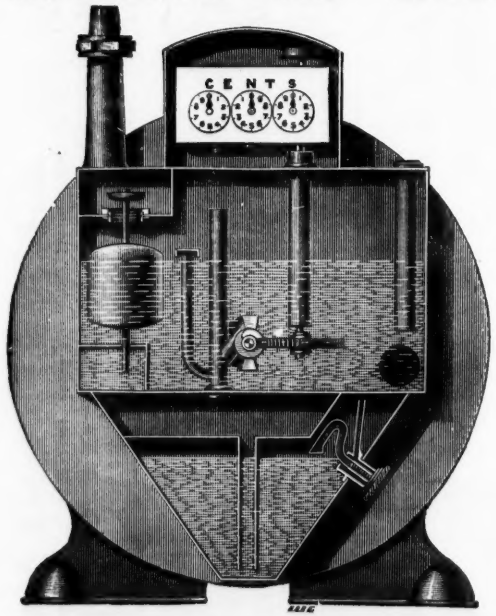
THE SYPHON OVERFLOW

— Wm. Cowan's Patent. —

To suppose, as some do, that the main object of the "Syphon Overflow" is to promote the convenience of inspectors and others who "water" meters, is to misapprehend the chief purpose of the invention. That the convenience of inspectors is promoted by the Syphon Overflow is a fact that admits of no doubt whatever, because the watering of meters is thereby greatly facilitated; but it is a mistake to fix attention upon this result, and to regard it as the only one attained. To do this is to lose sight of the chief purposes the Syphon Overflow was designed to secure.



These purposes were—

1st.—The **speedy** attainment of **exactly the same water line** on each occasion of watering.

2nd.—The **absolute certainty** of this water line being attained.

3rd.—The **impossibility** of any water afterwards finding its way into the waste-box.

The first and second of these conditions secure the interests of the gas company, whilst the third greatly promotes the convenience of the consumer, for reasons that are well known.

Who that has had experience of Wet Meters does not know the disadvantages of the "Low Spout?" The slowness with which it adjusts the water line, and the patience required while this is being done, are matters of every-day experience. It is therefore no wonder that the "Syphon Overflow" is regarded as one of the most important improvements ever made in the Wet Gas-Meter. It is not only an important improvement **in itself,** but it possesses the property of making all previous improvements more valuable and effective. It has, indeed, made the Wet Meter a more perfect, and, in every way, a more satisfactory instrument.

Narrow views as to price often prevent the adoption of real improvements; but it would be a narrow view indeed which would prefer a "Low Spouted" Meter to one with a "Syphon Overflow," because of the trifling difference in the price of the two.

— W. & B. COWAN, —

— ESTABLISHED 1827. —

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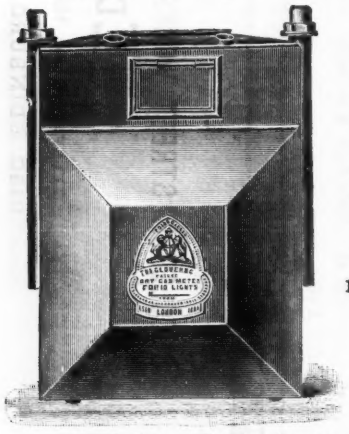

1st.—Are a remedy for all the defects of Wet Meters.
2nd.—Are suitable for all Climates, whether hot or cold.
3rd.—Incur no loss of Gas by Evaporation.
4th.—Cannot become fixed by Frost, however severe.
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10th.—Will not cost more than one-half for repair that Wet or Water Meters do.

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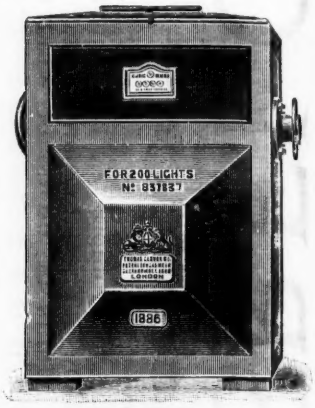

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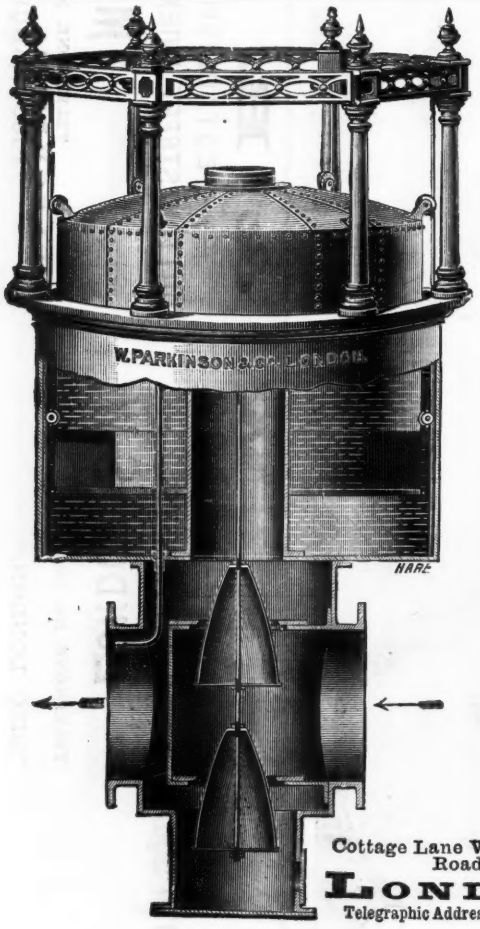

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Office: 10, Mawson's Chambers, Deansgate, **MANCHESTER.** Telegraphic Address: "Precision."

[See also Advt., p. 708.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, OCTOBER 18, 1892.

The Gas Affairs of Paris.

As an exercise of ingenuity, the scheme of the proposed new Treaty between the Paris Gas Company and the Municipality, the heads of which will be found in another column, is worthy of the attention of all gas-works administrators. We have so often mentioned the Paris Gas Question in these pages, that it is unnecessary to explain the reasons why there is such a question, and why it is so difficult of solution. It is sufficient here to say that the whole of the trouble has grown out of the consequences of the blunder of the experts who settled the terms of the concession of 1856, when the gas supply was consolidated in one undertaking, in making reductions of price depend upon technical instead of on commercial considerations. Nothing has happened in the domain of technics since that epoch to show that the Paris Gas Company can make gas more cheaply now than they could then. But, of course, as a matter of fact, their profits have immensely increased; and although they share the extra profits with the Municipality to a certain extent, this is no consolation to the consumers. Nobody is satisfied with the existing condition of things, because the public feel that the consumers are imposed upon, and the odium of perpetuating the *régime* of dear gas falls upon both the Company and the Municipality. Moreover, although the increase of the profits of the undertaking goes on automatically, such usurious dividends are a standing invitation to anarchical marauders. The difficulty of reducing the price of gas in Paris is, however, the old one of trying to eat one's cake and have it. The Gas Company must keep up their sinking funds, and the Municipality cling pertinaciously to their subsidy; and how to discharge these obligations and yet cut away any substantial portion of revenue is the puzzle of would-be reformers. As will be seen, a scheme has been prepared which has met with more approval than any of its numerous precursors, and seems to have a good chance of adoption by the Municipality, who have the last word in the matter. Some of the details of the project are open to criticism; but, on the whole, it strikes us as the least objectionable of all the arrangements that have been suggested to the same end. It starts from the datum of the expiration of the existing Treaty at the end of 1905, so as not to disturb the financial provisions that have been made with reference to this eventuality. As from this period, the Municipality may or may not assume the administration of the undertaking, and may require the Company to carry it on under stipulated conditions for another 25 years. Here comes the consumers' opportunity. An article of the scheme sets forth that, after a certain net profit has been realized, one-half of the remainder is to be allocated to the consumers in proportion to the amount of their receipted gas bills for the year, which is to be payable in cash to the contributors, and in the case of continuing customers will be deducted from the first sum recoverable from them after the publication of the accounts. The other alteration affecting consumers will be the payment of interest at the rate of 3 per cent. upon their deposits, which is also to be allowed to them at the end of every year.

Of course, the terms of this Treaty possess only an academical interest for us; and we cannot suppose that anything we can offer by way of criticism upon it will have much weight with the framers of the new contract. But it does appear to us that, if the scheme goes forward as it stands, the Parisian authorities will sacrifice a great and irrecoverable opportunity. They were quite justified in declining to prolong the Company's concession on the old terms, or nearly so, for the sake of an immediate reduction in the price of gas, which has been the beginning and end of all the earlier suggestions by the Company. We have nothing at present to say as to capital arrangements either up to or after 1905; these being doubtless correct, and fair to all parties. In the interest of the undertaking, as well as of the consumers, however, it appears that the kind of share in the profitable working of the concern which it is proposed to give to the consumers, is the worst that could be conceived. Why not simplify the whole matter, and apply the money where it will do the most good, by reducing the price of gas for the future instead of returning it to consumers in the past? Under the proposed scheme, the largest consumers, who presumably need it least, will derive the most benefit; and where is the satisfaction of receiving a credit allowance some time after the bill to which it relates has been paid? It is the price of an article, and the necessity for finding the money to pay for it, which strike the purchaser. Of course, a deferred credit is better than nothing at all; but it is the least effective way of encouraging trade. Then as to the payment of 3 per cent. interest on deposits—why not encourage consumers to pay deposits as investments; allowing (say) 4 per cent. interest, by way of inviting the public to participate in the undertaking? It is disappointing to find a present-day Municipality neglecting this opportunity for popularizing such a splendid property as that which inheres in the gas supply of Paris. Judged from the popular standpoint, the scheme is old-fashioned to the verge of the reactionary. Perhaps, however, it is not too late to amend it in this respect.

A Piece of Sharp Practice.

A CORRESPONDENT, who shall be nameless until he sees fit to come forward and tell his own story, sends to us a

statement relating to a peculiar bit of gas company finance which we would fain believe to be unique. It is a tale of an issue of premium capital according to a method which is perhaps legal, but which appears to accentuate the circumstance that the old-fashioned word "equitable" does not form part of the title of this particular Company. At the commencement of the current year, the Directors advertised for further capital, which was to be issued in £25 shares. Our correspondent tendered for ten of these shares, according to the conditions issued by the Board, one of which required that the amount of premium offered per share should be stated; and one-half of this amount was to be forwarded with the application; the balance of the premium and a first call of £5 per share being payable within the ensuing fortnight. Fulfilment of these conditions meant, for our correspondent, parting with the whole of the premium he was prepared to give for the possession of ten £25 shares in this Company, while the call upon them only amounted to £50. So far good. The Directors were careful to tell applicants that no further call could be made at a less interval than three months; and the new shareholder waited in what he considers the reasonable expectation of being required to complete his investment at the earliest opportunity. He still waits; for it transpired that this ingenious Board had no immediate intention of calling up the remainder of the nominal amount of their new share issue. They obtained the very handsome premium of £250 on an investment of £50; and at the end of the half year they duly sent to the fortunate investor a warrant for the dividend due upon the latter amount. He, however, having parted with £300, was not so well pleased with the return; and he now naturally wants to know what the Board mean by their conduct. Inquiry into the state of the Company's capital account has not brought him any comfort; for it now appears—what was not set out in the prospectus of the new issue—that there had been a previous issue of the same class of shares, upon which only £15 is paid. So that the Board have appropriated the whole of the old and the new premiums, to the injury of both sets of holders of their £25 shares; and there is nothing to hinder them from repeating the trick for as long as their power of issuing new shares holds out.

It is unfortunately only too clear that the over-confiding investor has been "had;" and we cannot see that he has any remedy against this very sharp Board, who have already enjoyed the use of his premium payment of £250 for nine months, in consideration of paying interest upon £50 only, and who may postpone calling up the balance indefinitely. It appears to be a piece of that penny-wise, pettifogging policy which at one time passed for wisdom with hole-and-corner gas companies, and brought them into such disfavour with the public as resulted in many costly parliamentary conflicts. It would be interesting to know if our correspondent's experience is singular. There can be no question as to what is the right and fair course to be adopted in issuing premium capital. The whole amount of the investment should be paid in at once; because it is for the dividend upon the whole of his shares that the investor offers his premium. Nobody can doubt that the amount of the latter would be very seriously affected if the tenderer knew the shares to which it applied would only be partly paid; and it is sheer dishonesty to take a man's money without giving him fair value for it, whether the article purchased be gas shares or anything else.

Regarded generally, this incident raises the question whether in future Gas Acts the obsolete provisions as to paying up new share capital by instalments should be retained. The requirement that calls should not be made at less than three months' intervals had reference to a state of things which has ceased in the case of a gas company able to command a premium upon new issues, and ordered to place such issues at the disposal of the public. It was devised to prevent the "freezing out" of weak holders by strong Boards for their own advantage. But it is no longer needed for this end; and—as often happens with superfluous parts of an organism—we now see that the retention of such a provision may suggest an injurious instead of a beneficial use.

Two Explanations.

It is a satisfaction to have been instrumental in eliciting the truth about anything; and we are particularly glad to receive the letter from Mr. Eames Rogers, Secretary of the Carlow Gas Company, which appears in our "Correspondence" columns to-day, and corrects the false statement of certain electricians respecting the relative positions of gas and electric lighting in Carlow. A fortnight ago we repeated a story circumstantially told by Messrs. J. E. H. Gordon and Co., and accepted unquestioningly by an electrical contemporary, of how the Carlow Gas Company had issued a circular threatening to cut off gas from any premises where the electric light was in use. Now we know the rights of the matter; and in all probability Messrs. J. E. H. Gordon and Co. and the *Electrical Review* will be "sorry they spoke." Not only is the circular in question proved to be a figment of the electrical mind, but the fine spirit revealed in Messrs. Gordon's offer to take over the lighting of the whole town looks queer beside the statement that their success up to the present is represented by the patronage of 14 out of 203 of the Gas Company's customers. Carlow is a small place, it is true; and the local Gas Company are not under statutory obligations to supply anybody with gas or with meters unless they think the connection likely to be profitable. Thus they are in a certain sense as much "adventurers" as the electricians, and have no advantage except the quality of their ware. But to what straits must Messrs. J. E. H. Gordon and Co. be reduced, to have to put on such a pitiful bit of swagger about a poor little job like this. While mentioning the electricians' ways, we may as well avail ourselves of the opportunity of remarking that the partisans of electric lighting in Belfast take very much amiss our recent references to the gas question in that city. One of the local papers has fallen foul of us for maintaining that the Belfast gas-works must be enlarged; and, after depreciating our position in regard to the matter as not "disinterested," warns the people of Belfast that they had better await the publication of some articles in course of preparation by a "Special "Commissioner" of this enterprising journal, which will tell them all about the prospects of gas and electricity everywhere, before deciding to give Mr. Stelfox what he demands in order to keep the city from darkness. As to this impeachment, if our Belfast critics knew us better, they would understand that we never pretend to be disinterested, which in journalism is often only another way of spelling uninterested. And with regard to the "Special Commissioner" of the Belfast newspaper, we shrewdly suspect that, if he has quitted home, it is pretty well understood what he is to bring back. Moreover, a sounding title does not render a man competent to express a trustworthy opinion respecting everything he sees or hears. Our references to the experiences of Glasgow and Liverpool are also twisted into a denial of the existence of electric lighting enterprise in these cities. We never meant anything of the kind, but only to illustrate by potent examples our contention that electric lighting has no effect whatever upon the rate of extension of a gas undertaking. We are not so foolish as to maintain that electric lighting has no prospects, of a kind, in Glasgow or Liverpool, or London or New York; but what we do say is that nowhere does it take up the increase of the gas undertaking. In New York, where there is plenty of electric lighting, its only effect upon the Gas Companies has been to reduce from ten years to six the period during which the manufacturing capacity of the gas-works has to be doubled. Our interest in the Belfast gas question does not extend to the placing of the new works. The Gas Committee may build anywhere they please, by wholesale or in little bits; but that they will have to extend their works somehow is as certain as that night follows day.

A Monopoly of Mineral Oils.

Moralists have made great use for centuries of the traditional offer by an Emperor of Rome of a substantial prize to the discoverer of a new pleasure. It is very certain that there is more than one living Emperor, King, or Republican President, who would give a good deal to the inventor of a fresh way of raising revenue by taxation that cannot be felt. English taxpayers think themselves hardly used by their Government; but, although it is difficult to make a reliable comparison in this matter, there is probably no country in Europe which gets off so lightly as the United Kingdom, having regard to the objects for which taxes are levied. On the other hand, it would be difficult to name a land upon which the weight of taxes lies so heavy

as on Italy, where a man can do nothing without paying some tax or duty for the privilege. We are led to refer to the condition of this unhappy country, which is being ground down by taxes in order that a top-heavy army and navy may be after a fashion maintained, by a report that lately appeared in the newspapers respecting the last new nostrum by which the Italian Ministry propose to effect an equilibrium in the national finances. It is stated that, in order to prepare the way for the taxation reform which the country so greatly needs, "the Government will reserve "for the State the importation and sale of mineral oil "used for lighting purposes." It is not to be supposed that illuminating oils at the present time pay no duty in Italy. As a matter of fact, they pay duty at least twice over, as in France—once to the Customs at the port of entry, and again by way of *octroi* to the Municipalities of the towns where they may be consumed. This new device of the Italian Government is intended merely to give the oils another squeeze. If the scheme is carried out, the licensees of the right to sell tobacco and salt who carry on their strangely connected trade in every Italian town, will have to add a third counter to their shops, and run the further risk of contaminating the already rank native tobacco with the flavour of petroleum. Why does not the Italian Government appropriate all the gas-works, and forbid the use of candles throughout this dark peninsula? The seizure of the whole trade in mineral lighting oils by the Government portends no good to gas; because the people will so stint themselves for light at home, that they will be resigned to the sparing use of it in the streets and business establishments. The bare idea of a Government placing restrictions upon the employment of any kind of artificial light is repugnant to modern feeling. But the people of Italy will not object; they will sit in the dark after nightfall to enable their Government to pose as one of the Great Powers of Europe.

The Confusion of Scientific Societies.

MEN of science throughout the United Kingdom are now growing sorely perplexed on the subject of their Societies for the collection and publication of scientific intelligence, which, from the Royal Society downwards, overlap and interfere with one another in a highly perplexing and most mischievous way. These reflections appear to have gained in point and urgency since the British Association meeting, which was more of an *omnium gatherum* affair than ever. A "bitter cry" has accordingly gone up from the man of science who does not know where it would be best for him to take his papers, for a systematic reorganization of all the philosophical societies upon a rational basis, with a view to giving every branch of study and research its own centre of collection, discussion, and publication. He professes his willingness to meet once a year or so in amicable concert with other specialists, for which practice there is unquestionably not a little to be said; but what he does want in a most particular and urgent sense is a centre of gravity of his own. If he has a paper to read, he wishes to give it before the right audience, and have it published in the right "Trans-"actions;" and when he wants information respecting what is going on in his own line, he seeks to be relieved from the present obligation to chase it through a library of reported proceedings of the various Societies which might be suspected of harbouring it. The same trouble afflicts workers in applied science, as our useful contemporary *Industries* admits. As to the Societies in Great Britain that are open to receive technical communications respecting matters of interest to followers of the gas industry, their names are too numerous to be given here. Of course, like the conductors of all respectable technical and trade periodicals, we endeavour to make the JOURNAL a compendium of the literature relating to its own subject; but in the absence of such a means of tracing a paper or memoir upon a gas topic, where would the student find it? The grievance is a serious one; and it is the fruitful cause of much loss of time and waste of instruction.

Masonic.—The friends who so kindly assisted with their votes in the case of Henry Reeves Harris, for election into the Royal Masonic Institution for Boys, will be gratified to learn of the success of this case. At a Quarterly Court of the Governors of the Institution held last Friday, from an approved list of 37 candidates, 24 were elected; and Harris stood at the head of the poll with 3852 votes. Mrs. Harris desires us "to return her grateful thanks to all who have helped to secure the election of her son."

WATER AND SANITARY AFFAIRS.

WE give in another column the "authentic account" promised a few days ago by Lord Balfour of Burleigh, respecting the interview between the Royal Commissioners on the Metropolitan Water Supply and Sir George Buchanan. It will be seen that the evidence given at that interview was of considerable length—occupying several columns of the JOURNAL. There is no doubt that the primary object of the Commissioners in calling Sir G. Buchanan before them at the very outset of their inquiry, was to receive any suggestions that Sir George might be able to offer as to an effective mode of testing the quality of water. If such a mode could be pointed out, the Commissioners were anxious to have it applied. The expert whose counsel was thus sought commenced by saying that, with regard to the water supply of the Metropolis, he had no special information to give. It would seem, in fact, that Dr. Frankland was the man the Commissioners really wanted. Sir G. Buchanan stated, concerning himself, that the investigations he had been connected with were for the most part in cases of water supply elsewhere than in the Metropolis. He spoke of the tests applied by Dr. Frankland to determine organic impurities, as being probably the best of their kind. But the Commissioners sought for something more than a chemical test; their object being to discover whether organisms hurtful to the human species existed in water after filtration. Sir G. Buchanan again confessed to an absence of knowledge, giving as his reply: "I think I should say I have no information on "the subject." Admitting that Dr. Frankland had "some-"thing to tell us" each month as to the number of microbe colonies he found in the London water supplies, Sir G. Buchanan yet declared that the investigation was "of no "earthly value for the demonstration of morbid elements." At present, no means existed for ascertaining the "relative "harmfulness" of the animalculæ found in the water. Neither was he confident as to the absolute removal of microbes of every description from water that had once been infected or made impure by them. He had never known evidence of all the microbes having been absolutely removed, though he was aware that Dr. Frankland could record the absence of any microbe colonies—that is, of microbes which would, at the moment, "consent to grow "into colonies under the conditions of his experiment."

We pause here to observe that Sir G. Buchanan evidently considers we can have no assurance as to the wholesome character of water, so long as the supply retains any microbes whatsoever. Seeing that we cannot distinguish between pathogenic microbes and those that are harmless, it is argued that our only security consists in excluding microbes of every kind. Thus Sir George declares: "With "my present knowledge, I should prefer to have water "with absolutely no organisms in it." But is he able to find such water? It would be interesting to know what water it is that Sir G. Buchanan drinks. His residence is situated in the Metropolitan area; and possibly he has a supply from a deep well in the chalk. But if so, is he quite clear from the microbes? Dr. Frankland's monthly reports show that organisms are present, even in water taken direct from the wells of the Kent Company. Is Sir G. Buchanan setting up a practicable standard, when he demands that the microbes shall be entirely shut out? Will Lake Vyrnwy furnish such water? If ever the Metropolis gets a supply from Mid-Wales, or from Devonshire, will the water as it reaches the consumer be actually sterile? The dilemma is even greater than this; for, when Dr. Frankland brings forward a sample of water from which no colonies of microbes can be obtained, Sir George remains doubtful as to whether some obstinate organisms may not yet remain in ambush. How nearly entire exclusion takes place in the regular process of filtration by the London Water Companies, appears in the monthly reports of Dr. Frankland. Making reference to the report for last month, we find that 1947 colonies of microbes per cubic centimetre in the Lea at the East London Company's intake are reduced to 9 in the supply. This corresponds to an exclusion of 99·54 per cent. The microbes in the untreated water of the New River cut developed into 737 colonies per cubic centimetre; but the supply only contained 3 such colonies—thus showing a reduction of 99·6 per cent. The exclusion of the Thames microbes in the case of the Grand Junction supply is 98·95 per cent.; and one of the filters in the Southwark

and Vauxhall works excludes 99·37 per cent. There are no more microbes per cubic centimetre in the New River supply than in the Kent, although the former has to encounter above 700 microbes in the untreated water. The result shows the efficacy of the filtering process as practised by the London Water Companies, and justifies the commendation which Dr. Frankland has bestowed upon it. Concerning the general tenor of Sir G. Buchanan's evidence, it resolves itself, as we intimated on a former occasion, into a disparagement of the chemical and microscopical tests now applied to water, including Dr. Koch's bacteriological process, and it supplies nothing in their stead. Water is to be taken from an unpolluted source—if one can be found; and the puzzle is that the highly-approved water may be found to yield as many microbes as that which we are told to "boil or let alone."

Our friend of former days, Mr. Archibald Dobbs, has re-appeared, this time as the leader of an agitation against the Lambeth Water Company on the bath question. The Company make an extra charge where a house contains a bath; and the Camberwell Vestry, in conjunction with certain ratepayers, contend that the charge is illegal. Yet the law which governs the Lambeth Company seems clear enough. The Act stipulates that the supply of water for domestic use does not include water for "baths," and for certain other purposes. An attempt is made to show that "baths" mean "public baths." Yet it seems impossible to conceive that "public" baths should be made an exception in a clause relating to the domestic supply. Public baths are so obviously outside the range of domestic use, that it could not be needful to declare that such was the case. Baths in a dwelling-house would naturally call for some allusion; and the Act places them outside the domestic supply, as it does the use of water for washing carriages and watering gardens. One of our contemporaries remarks that the importance of the matter to the general public lies in the fact that "when the community "takes the water supply over, the price will be reckoned "on the income." Perhaps we may suggest the further consideration that when somebody "takes over" the water supply, the income will be taken with it. However, this affair will amuse Mr. Dobbs, and possibly will not hurt the Company. We observe that Mr. Dobbs is good enough to advocate "a compromise," by which houses of less annual value than £30 would have their fixed baths without paying anything extra. But the Company would naturally look upon this rather as a surrender than a compromise, so far as they are concerned.

"The Science and Practice of Lighting."—Our readers will see, by an advertisement which appears elsewhere, that the series of articles on "Lighting" which were lately contributed to the JOURNAL by Mr. W. H. Y. Webber have been reprinted with some slight additions, and issued in book form under the above title. The subject is treated in five chapters; the text being illustrated, where necessary, by diagrams. The book is bound in lettered cloth.

Presentation to Sir Frederick Mappin, Bart., M.P.—A movement initiated a short time ago to publicly recognize the services rendered to his native town by Sir F. Mappin, Bart, M.P., the Chairman of the Sheffield United Gas Company, was brought to a successful termination last Friday evening. The project was carried out by Mr. Alderman Clegg and a Committee, whose appeal to their fellow-townsmen resulted in the raising of about £1400; the responses coming from all classes. The original intention was to have a portrait of Sir Frederick painted for placing in the Mappin Art Gallery. But the subscriptions were so numerous that ample funds were forthcoming for one of Lady Mappin also; and the Committee wisely resolved that this should be presented to Sir Frederick, to find an honoured place among his art treasures at Thornbury. Even after this there were funds sufficient for a magnificently illuminated album, which contains a record of the proceedings of the Committee, and the names of every one of the subscribers. In their selection of the artists, the Committee were exceedingly happy. They gave the commission for Sir Frederick Mappin's portrait to Mr. W. W. Ouless, R.A.; and that of Lady Mappin to Mr. J. J. Shannon—a rapidly rising and distinguished painter. The presentation took place in the Art Gallery; the ceremony being performed by the Mayor (Mr. Alderman Gamble) in the presence of a crowded assembly, notwithstanding unfavourable weather. The portraits were unveiled by Mrs. Clegg and the Lady Mayoress amid enthusiastic applause. Sir Frederick acknowledged the gift in a felicitous speech, which he concluded by thanking all—rich and poor—for the honour they had conferred on Lady Mappin and himself, and by wishing them every happiness and prosperity in the future. The Right Hon. A. J. Mundella, M.P., was present, and proposed a vote of thanks to Mr. Alderman Clegg, which was carried by acclamation.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 698.)

THE great improvement in business which was remarked upon last week, has made a considerable advance in the week just closed. A very cheerful feeling prevailed, and prices in some markets rose very freely. Great activity prevailed, notwithstanding the intervention of more Jewish holidays; and the fact of the settlement being got through without a hitch added to the general rosy hue of affairs. It may, however, be prudent—if not altogether pleasant—to hint that in some markets the boom was perhaps a trifle too enthusiastic, and prices were rushed up too quickly. South Americans, for instance, were a bit overdone. The Money Market is better; the foreign demand for gold being fairly considerable, and establishing better rates. The Gas Market, although sharing in the general upward movement, did not exhibit the same degree of activity as the rest; transactions being much more limited than in the preceding week. In Gaslights, "A" was dealt in to about an average extent. It maintained its quotation, but did not show any disposition to improve upon it. The secured issues—debenture, preference, and limited—were all brisk and in good favour; the figures realized even warranting a small advance in the prices. South Metropolitans were very quiet, but equally firm, though the only change was an advance of 1 in the "B." A couple of deals in Commercial old were all the business done in that quarter; but *ex div.* quotations come out ½ better for the old stock and 1 better for the new. The Suburban and Provincial Companies also show well—Bristol taking the lead with a jump of 7. The Company disposed by auction on Wednesday last of £31,300 of 4 per cent. debenture stock, at an average of nearly 105¼; thus costing them a trifle over 3¾ per cent. per annum for interest. The Continental undertakings have all made further improvement. Imperial announce their usual 5 per cent. dividend and 1 per cent. bonus. The greatest rise has been made by the South Americans, carried up by the general boom which is referred to above. The rest are unchanged. The Water Companies, as a rule, have been very quiet; and the only variation in them is a rise of 4 in East London.

The daily operations were: There was not much activity in Gas on the opening day; but prices for everything touched were above the average, except for Gaslight "A." Business on Tuesday was not greater, though more evenly distributed throughout the list. Bristol rose 7; Monte Video, 1; Buenos Ayres, ½; and do. debentures, 2½. Wednesday was altogether a quiet day; and the only moves were improvements of ½ each in Pará and San Paulo. Thursday's transactions were also limited; but the upward advance proceeded. Continental Union rose 2; and European and Imperial, ½ each. Friday was a shade busier, and still improving. Commercial old rose ½; ditto new, 1; South Metropolitan "B," 1; British, 1; and Buenos Ayres and San Paulo, ½ each. East London Water rose 2. Saturday was extremely quiet; and all quotations closed unchanged except for a further rise of 2 in East London.

ELECTRIC LIGHTING MEMORANDA.

An Old Experience Repeated—Cooking by Electricity—Electrical Tramcars in the United States.

IN many respects electric light purveyors are repeating old experiences of sellers of illuminating gas, especially in matters of trade. We recently noticed a decision of the United States Treasury officials to the effect that electricity, not being a tangible substance, can be imported into the States free of Customs duty. Later it has been reported that a Judge at St. Louis has refused to convict a person of larceny for stealing electricity by tapping somebody else's circuit. It was very like this at one time in respect of gas. But the difficulty was set right by statute; and the precedent has been copied for the benefit of the younger race of electricians. There can thus be no question of the fact that in this country currents of electricity are private property, and therefore can be dealt in commercially. To the lay mind it would appear that anything which is susceptible of being bought and sold, even although not tangible and of unknown nature, must be susceptible of larceny and fraudulent dealing, for which the common law might be expected to provide a remedy. But lawyers have wonderful powers of discrimination between things which are property and those which are not. It is commonly understood that there is no property in wild beasts; and, according to the view of the St. Louis Judge, electricity must be regarded, in America at least, as an untamed creature unamenable to law.

At last the blow has fallen! Scouted as a means of lighting, gas has hitherto been allowed even by the prophets of electricity some prospects of passing a humble, but useful, future in the kitchen as a convenient source of heat. This consolation has now been taken away by the remorseless Crompton Company, who have proclaimed their readiness to supply electrical cooking-stoves capable of doing all the work of gas-stoves, and at not too great a cost for these appliances to come into public use. It is claimed that dinners were for some time

cooked by electricity nightly at the Horticultural Exhibition; and something has been said about a project for fitting electrical cooking-ranges as well as electric lamps in some "flats" in the Kensington district which enjoys the privilege of being served by the Crompton Company. Up to the present time, the only cooking done by electric lighting companies has been that of accounts; and if they should prove to be only half as skilful in their treatment of edibles as they are in handling figures, all the gas-stoves in use at present will speedily return to the scrap heap. The imagination fails before the possibilities that may attend the introduction of "French measurement" into tests of electrical cookers. Manufacturers of gas-stoves have done pretty well in regard to demonstrating the superior economy of their wares as compared with coal-ranges. We forget for the moment for how many people a dinner can be cooked by any self-respecting gas-stove for a penny; but it is a highly comforting figure for fathers of large familes. Once let the Brush people get hold of this new opening for their genius, however, and the least we may expect is proof that the use of an electrical cooker will go a long way towards paying the butcher's bill.

It is often stated in the newspapers and by professional apologists for electric supply companies, that the application of electricity to the purpose of tramway working is more popular in America than it is here. The system of driving tramcars by electricity which is most general throughout the States is that known as the "trolley-wire" method, in which the current for actuating the motors is taken from overhead wires by a traveller attached to the car. Some time ago, one of the English technical journals published a reproduction of a photograph showing the "trolley-wire" arrangement as applied in a main thoroughfare of Boston, Massachusetts, and gave it the qualified recommendation of being not unsuitable for a road in some poor London suburb, or in a manufacturing region where appearance is no object. Evidence has come to hand, however, which goes to show that not all of the citizens of Boston love the trolley-wire cars which reckless or venal town administration has let loose upon them. A recent laudatory report in an American electrical journal respecting this experiment in road locomotion was copied into the *Scientific American*, with the effect of evoking from a disgusted Bostonian correspondent the declaration that "electric cars have been the greatest nuisance that was ever put into the streets of Boston." So far from improving the street traffic, the system is stated to have greatly impeded it, especially in the business centres, where it has blocked the thoroughfares and brought great danger to life and property. There is no regularity in the service, which is always breaking down, "so that we often find a mile of heavy cars in line, with not enough power on a single trolley-wire to move but a few at a time. Horses and men have been killed and injured by falling wires; and one of the worst fires in Boston, where three or four million dollars' worth of property and several lives were lost, was set by an electric wire which was supposed to have come into contact with the trolley system." Moreover, so many accidents are caused by the wires, that the amount paid by the Company by way of damages during the last fiscal year was $149,592·42, "with perhaps full as many more unsettled claims." It is believed, says this critic of the trolley-wire system, that the Company using it can never earn a dividend—which does not prevent dividends of 8 and 10 per cent. being paid; for it is stated that "in Massachusetts dividends can be paid out of capital stock or borrowed money." What a Promoters' Paradise this State must be! It is no wonder that electricity does so well in America under such favourable conditions. Now one can better understand the reason why the speculative electricians of the early English period which ended with the passing of the Electric Lighting Act were so incensed against Mr. J. Chamberlain for forcing on this measure.

Imperial Continental Gas Association.—The Directors of this Association will recommend, at the half-yearly meeting of shareholders on the 1st prox., a dividend of 5 per cent., and a bonus of 1 per cent., for the six months ending June 30 last.

Presentation to Mr. T. N. Ritson.—As already announced in the JOURNAL, Mr. T. N. Ritson, Assoc. M. Inst. C.E., who for about ten years held the position of Assistant-Engineer and Manager of the Jersey Gas Company, has been appointed Manager of the Kendal Gas and Water Works. Shortly before leaving Jersey, the Directors of the Company took the opportunity of specially marking their appreciation of his services by presenting him with a handsome clock and a pair of candlesticks—the former bearing a suitable inscription. The presentation was made by the Chairman (M. Jurat Gallichan), who appropriately referred to the eminently satisfactory manner in which Mr. Ritson had always fulfilled his duties. Other mementoes of Mr. Ritson's connection with the Company were offered by the office staff and the workmen; the former giving a silver fish-knife and fork; Mr. J. Morris, the Engineer and Secretary, a box of drawing instruments; and the employees, a stereoscope. It must be gratifying to Mr. Ritson, in entering upon his new duties, to feel that he does so with proofs of the good-will of those with whom he has lately been so closely associated, and with their best wishes for his future prosperity.

THE WARMING OF TOWN BUILDINGS—SUGGESTION FOR A CONFERENCE.

ANOTHER autumn season is upon us, with the usual meteorological symptoms and effects, which we are not going to weary our readers by recapitulating in detail. Humorists make fun year after year of the callow enthusiasts who plague newspaper and magazine editors with crude poems extolling the Beautiful Spring or the Beautiful Snow, as the appropriate solstices come in their immutable rotation. But there is another afflictor of his species to whom the times have given birth—the man who, as soon as the first autumnal fogs appear, utters his moan over the smoke nuisance of our ever-growing towns, and raises his ineffectual clamour for "something to be done" in this matter, which is popularly voted to be urgent every winter and as generally forgotten every summer. We like to discuss the subject in its most immediate bearings at least once a year. True it is that these pages contain more than one passing reference to smoke prevention during the twelvemonth; but these comments are provoked by the occurrence of special suggestions from without. Somebody reads a paper, or writes an essay, or takes out a patent dealing in a particular way with the subject; and these contributions to an already extensive specialized literature have to be examined and criticized. As year follows year, however, and the smoke nuisance still remains with us, it is desirable to devote a column or two of the JOURNAL space to a general survey of the whole subject, in order that progress towards the solution of the problem, or the lack of it, may be fittingly realized.

This time we do not propose to waste time in showing how deeply interested the gas industry is in the practical solution of the problem of town smoke, or to do more than mention, for the sake of providing our observations with a proper basis, the well-established fact that in Metropolitan and other residential districts it is the domestic fireplace that constitutes the *crux* of this the greatest difficulty that modern sanitarians have to face. There are parts of the kingdom—as Manchester and its environs—where the apparent hopelessness of the domestic hearth, as judged by the sanitary reformer, is dwarfed by the mischief created incidentally by certain manufacturing operations. When the recent revival of public interest in the smoke question first drew renewed attention to the operation of the statutes bearing upon the behaviour of factory chimneys, it was deemed conclusive of the matter to refer to the difference in this regard of London, where the Acts are administered by the national Government, and of provincial districts, where they are allowed by the local authorities to become a dead letter. There is an air of sufficiency about the argument that corporations which are largely composed of, and even more largely influenced by the millowners, cannot be expected to enforce laws against which these factory proprietors are themselves the most conspicuous offenders. During the last year, however, it has been demonstrated in the case of Manchester, that the apparent conclusion is not conclusive; but that, after all due allowance has been made for the promptings of self-interest, it is practically impossible to bind all industries in the chain of one set of regulations designed for the prevention of air pollution. This result may not be an encouragement to sanitarians; but it is nevertheless something with which they must make their account.

Leaving this part of the subject, let us return to the question of the domestic fireplace. Only last week, Mr. Ashby Sterry, a pleasant writer who is nothing if not a mouthpiece for others of his epoch and breeding, celebrated in sympathetic words the common joy which town residents now feel in knowing that the travels and turmoils of the summer holidays are over, and that the householder may rest at peace in his own chimney corner, and revel in the supreme comfort of the "first fire of the season." What does he care that this indulgence in the first fire is also the signal for the assembly of the elements that will soon come upon the town as the first fog? No more than the solitary-dwelling gamekeeper thinks of the corresponding fact, that the reek of his evening blaze adds to the picturesqueness of the "twilight falling brown" upon silent hill top and misty valley. Meanwhile, is there any indication, as the winters come and go, that the town resident finds it increasingly necessary, or even desirable, to manage his house-warming arrangements differently from the dweller in the country? It is in the dawn of this discovery that the hope of the sanitary reformer reposes; and we wish it were possible to state with truth that the hope is a lively one.

This line of thought occurs with particular force to the engineer who watches curiously the progress of the transformation that is actually in course of being carried out in all our largest cities and towns. Everywhere the small, low, cramped shops, warehouses, office buildings, and residences that served the purpose of a past generation are being replaced by large, lofty, grandiose structures, that testify to the growing regard of the people of the present age for beautiful, healthy, and convenient housing. Of our suburbs, we need not just now speak—there is a wide zone of the cheap and makeshift in the way of business and private house-building, which may be lamented over, but must apparently be borne with in view of the exigencies of an infinitely graduated population. We have often pointed out that the gravest obstacle in the path of those who

would penalize smoky hearths wherever found, lies in the multitudinous examples to be seen in and around the wealthiest towns, where two or three bricks and bars and a handful of cheap, dirty coal represent the sole means of defence of abject shiverers against frost and wind. But, if the scanty resources of the poor afford little or no margin for any improvement in methods of warming which may be conceived in the general interests of the community, rather than in the narrow but more immediate behoof of the fuel user, surely it may be thought that this desired margin is ample enough in the case of the dwellers in and near the centres of civilization, whose "marble halls," wherein living and working are conducted amid every circumstance of luxury, are fast beautifyng the most congested town thoroughfares. If we consider only the two principal lines of communication that run through London from East to West—from the Docks to the Parks—we shall see many hundreds, it might be said thousands, of really palatial buildings, from which nothing that ministers to health or comfort has been excluded on the score of mere expense. What is the average condition of these houses, in respect of heating arrangements? It is only too certain that the answer to this question must be disheartening for the smoke preventionist. Many of the new and ornate rooms have gas-heating arrangements, usually adopted for convenience sake and to save the trouble of a coal fire; but with exception made for this substitute for firing, all the newest buildings have as many chimneys as apartments, and are all as they leave the builders' hands fitted for contributing their quota to the smoke-pall that makes the denizens' lives burdensome just when they desire most comfort.

The condition of householders of the same class in America is altogether different. Writing on the subject of house heating in the *Engineering Magazine*, Mr. Leicester Allen is able to treat of open fireplaces in the past tense. He says "these ancient fireplaces and mantels were in fact so capable of ornamental treatment, that, although their functional value, in the march of improvement, has passed away, they are still introduced and retained as features of interior design by the best modern architects. It is true that one of their functions—that of ventilation—is yet made available by the use of grate-fires, gas-logs, or miniature wood fires that but feebly recall the grand wood fires of former generations, but which serve to maintain an outward flow of air through their flues. For the most part, however, in modern houses, the whole affair is a pleasant fiction of utility, its sole purpose being for ornament." How far these words are from expressing the state of affairs in London, it is unnecessary to prove. For Mr. Allen, catering as a house heating and ventilating engineer for nineteenth century New York, the essential elements of any arrangement calculated to meet the public requirements are steam or hot water. He is so far in accord with his contemporaries upon this side, as to be able to admit that "gas and electricity as heating arrangements for buildings are yet to have their day;" but he is actually concerned with a half-way stage between heating houses by solid fuel in separate fireplaces, and by gas, to which we can supply no parallel.

It is not necessary to rely upon any one witness to the truth that the ideal American town house is grateless. The method of heating may be a matter of choice, as between direct radiation from steam or water pipes, or the so-called indirect method of heating by artificially-circulated warm air. But one of these, singly or in combination, is invariably adopted. So far as the warming and ventilation of public buildings is concerned, the American practice does not differ from the English; and we have yet to hear of anything done by English or American ventilating engineers which can be said to surpass, even if it can be adjudged as equal to, the heating and ventilation of the Sorbonne in Paris. The solution of the problem of smoke abatement, however, is not concerned with that of the independent problem of the warming of such public buildings as can be supplied with an air circulation by the agency of a fan. It is the private house, of whatever size—the house that is subdivided into a number of living and sleeping and service rooms—that has to be considered in connection with this problem. It seems like a reflection upon the extent to which science has been domesticated in England, that in scarcely one of the new residential and office blocks that are now rising on either side of the renovated main thoroughfares of London, is any systematic attempt made to deal with this subject upon duly-considered lines of convenience, cleanliness, and economy.

Why is it that methods of house heating, which have taken such firm hold of the citizens of New York and Philadelphia, are without charm for English townspeople? The reason is in the main, no doubt, to be sought for in the different climatic conditions. We do not need so much nor such regular heating as is necessitated by a hard New England winter; and then there is the old figment of the Briton's love for his fire to be combated by those who would attempt to warm a London tenement house upon communistic principles. It would be a gross mistake, however, to assume that open fireplaces are continued on their merits in our new-fashioned town blocks. In many of these structures, the multitudinous flues are found anything but satisfactory performers; and not a few persistently reverse their parts, pouring smoke into the apartments with which they are connected, instead of taking it away. It is, indeed, hardly to be expected that flues ten stories high can always be kept in proper working order by the poor little fires which are all that the English climate calls for during half our ordinary winter. When Mr. Ashby Sterry glorifies the fireplace, he quite omits to consider the case of a hearth that refuses to blaze as it ought, and thereby ranks itself among the greatest plagues in life. Unless we are misinformed, the concentration of population to which we have referred as providing a margin for the treatment of the smoke difficulty, is, as matters now stand, creating a special smoke difficulty of its own, in the shape of ineffective, although bulky and costly chimney stacks.

Nobody wants any more Smoke Abatement Exhibitions; but it is at least possible that a conference of architects, sanitarians, and engineers might profitably be held for the purpose of discussing the subject of the heating of tenement holdings by improved smokeless methods. We put the suggestion forward, for what it may be worth; and take the further liberty of remarking that if Sir H. Truman Wood, the Secretary of the Society of Arts, could see his way to induce the Council to organize such a meeting, it would be a worthy application of the power and resources of the Society. And, when the present position of the subject had been elucidated in this way, perhaps some public-spirited individual, recognizing the importance of the point at issue, might come forward with an offer of a substantial prize for the best solution of the problem, which would be a great stimulus to workers in this field. The hopefulness of this suggestion lies in its limitations; for it is clear that a trouble of such diversified origins and long standing as the smoke plague of modern English towns, is only amenable to remedial treatment in detail.

NOTES.

Structural Steel.

In the course of an article upon iron and steel bridge building, contributed by Mr. T. Kennard Thomson to the *Engineering Magazine*, the writer describes in simple terms his idea of the best quality of metal for this class of engineering construction, which also comprises roof and gasholder work. Mr. Thomson remarks how, in the reduction of iron ores to merchantable iron, the latter takes up more or less of the carbon and other substances used in the process, which remain in the finished metal as impurities of which the engineer must take cognizance. Of the forms in which iron is generally used, cast iron contains the largest amount of carbon, and is not now much used in structural ironwork. Wrought iron contains little carbon, and may be almost pure. Steel lies between cast and wrought iron in its proportion of carbon; being harder and more brittle the more carbon it contains. It is not necessary for the engineer, Mr. Thomson thinks, to specify the amount of carbon in the steel he requires. If he gets a steel which will break under a strain of between 50,000 lbs. and 65,000 lbs. per square inch, which will always regain its original shape after release from any strain up to 35,000 lbs. per square inch, which will stretch about 22 per cent. of its length before breaking, bend double upon itself without cracking, and show a good silky fracture with no crystalline appearance when broken, the engineer need not trouble himself about the percentage of carbon, as it will certainly be low. The only chemical test the engineer requires is that for phosphorus, which should never exceed 0·8 per cent. Sunlphur isearly as treacherous; but it is easily eliminated with the phosphorus. Some engineers specify steel, when used for compression members in structures, to stand a breaking strain of 70,000 to 80,000 lbs. per square inch; but Mr. Thomson holds that this grade of steel is not nearly so reliable as mild steel.

Tar Smoke Painting.

A somewhat peculiar method of applying coal tar as a preservative of ironwork is officially recommended by the Marine Department of the French Government. It appears in a set of instructions recently issued for the proper taking care of tubular boilers when out of use. The boilers are to be completely filled with water, to which a distinctly alkaline reaction has been imparted by the addition of a small quantity of lime or soda. All the external parts of the boilers are directed to be painted, where accessible, with either red lead or coal tar; but such parts as cannot be got at by the brush may be preserved by burning coal tar under them. It is remarked, in explanation of this order, that the smoke of the burning tar condenses in the cold tubes, and there forms a protecting layer which prevents corrosion. It would be interesting to know what justification there is for this method of using coal tar, since it is evident that, if it could be depended upon to give good results, it would be a cheap way of painting many metallic surfaces.

A Pipe-Line for Coal.

It is reported in an American technical journal that actual progress is being made towards the experimental realization of the patented invention of Mr. Wallace Andrews, President of the New York Steam Company, for piping coal from the Pennsylvania coal-fields to the Atlantic seaboard, already referred to in the JOURNAL. Mr. Andrews proposes simply to grind the coal to a fine powder, which is to be mixed with water in equal parts, and the resultant mud is to be pumped through pipes, precisely like those now used for petroleum, to its destination. Messrs. Means and Co., of Steubenville, Ohio, are constructing a settling and drying pan for the semi-fluid coal-mixture, which is to be placed on exhibition in New York. After the coal has

settled out of the water by which it has been carried, it is to be compressed into blocks, and used for fuel. It is in contemplation to pump the coal mud through the pipes at the rate of five miles per hour. Mr. Andrews claims to have pumped such a mixture a distance of 300 miles at the rate named, and he believes that a 12-inch pipe-line will deliver 5000 tons of coal a day. In connection with the grinding process, the coal is to be carefully washed free from slate, sulphur, &c. The Company already formed to exploit the Andrews coal-delivery patent have premises in the City of New York, where the system can be seen in operation on a small scale. It is a pity, from the point of view of the gas engineer, that there is no suggestion of a continuous acting retort to carbonize the coal mud as delivered.

The Convertibility of Speed and Power.

The discussions respecting the various methods by which power can be distributed through towns, or be conveyed from one place to another, have induced Sir Robert Ball, F.R.S., the Astronomer Royal for Ireland, to make a calculation with reference to the subject which may be useful to popular lecturers and others. Starting from the most general and obvious means of conveying power from motor to machine—the common leather belt—Sir R. Ball remarks that a light, fast-running cotton rope may be substituted for the heavy, slow-running belt, when the conditions are favourable to the exchange of speed for weight. Following up the line of reasoning thus presented, Sir R. Ball shows that a rope as light as sewing cotton running at the speed of a rifle-bullet, would carry a horse power. Proceeding to the extreme case of the lightest kind of line known (that of a spider's web) and the highest known velocity of travel (that of light), Sir R. Ball arrives at the astounding conclusion that if a line of spider's web could be driven at the speed of light, it would carry something like 250-horse power. This is a most instructive illustration of the idea of the conversion of energy.

Additional Capital for the Croydon Gas Company.—The Directors of the Croydon Gas Company have allotted the 500 ordinary £10 shares for which, as announced in our advertisement columns, they recently invited tenders. The last dividend paid on this class of shares was at the rate of 11 per cent. per annum. The minimum fixed was £22 per share; and the whole of the shares have been placed at an average price of £22 5s. 4d. each.

Marriage of Mr. David Laidlaw.—Many of our readers, both at home and abroad, will be interested to learn of the marriage of Mr. David Laidlaw, eldest son of Mr. Robert Laidlaw, of Glasgow, with Miss Annie Orr Stewart, third daughter of the late Mr. A. B. Stewart, of Ascog Hall, Deputy-Lieutenant and Convener of the County of Bute. The ceremony was performed in the fine library at Rawcliffe, Langside, the residence of the bride's mother. In celebration of the event, Messrs. R. Laidlaw and Son entertained at dinner, in the Windsor Hotel, St. Vincent Street, Glasgow, the members of the staff of their works in that city and in Edinburgh, as well as the staff of the Barrowfield Iron-Works, Limited. Among the numerous and costly presents were several from the employees at all these works. The business of the firm was commenced a hundred years ago by the great-grandfather of the present Mr. David Laidlaw—Mr. Robert Laidlaw, who died in 1851, and who took as his partner the Mr. David Laidlaw whose death occured about this time last year, as recorded in our columns at the time, and whose life-work was noticed in the JOURNAL for Nov. 24, 1891. The important firm whose progress is there sketched—and the record constitutes an interesting chapter in the history of gas and water engineering—now consists of Mr. Robert and Mr. David Laidlaw; thus making the fourth generation connected with the business.

Death of Mr. W. Upton Tinney.—It is with much regret that we record the death of Mr. William Upton Tinney, of Winchester, which occurred at Bournemouth yesterday week. Mr. Tinney was born at Hackney in 1825; and at an early age entered the service of the Chartered Gas Company, at Goswell Road. Subsequently he was connected with the late Colonel Croll; and in 1858 went to Winchester, and was successively engaged under the lessees of the Winchester Gas-Works, the late Mr. Samuel Pontifex, Mr. J. Stark, and Mr. Stephenson Clarke. In the course of a few years, however, this undertaking was merged in the Winchester Water and Gas Company; and Mr. Tinney was appointed Engineer and Manager—a position which he held till within a few months ago, when failing health necessitated the giving up of active service. His assistant, Mr. F. G. Dexter, was promoted to the office; and Mr. Tinney was elected to a seat at the Board. Under Mr. Tinney's supervision, the undertaking was largely extended to meet the increasing needs of the district. Mr. Tinney was an associate member of the Institution of Civil Engineers, a member of The Gas Institute, and also of the South-West of England District Association of Gas Managers. He always took a warm interest in the affairs of the latter body (although rarely able to attend its gatherings, on account of his Board meetings falling on the same days); and his hospitable reception of the members and their friends at Winchester in 1889 will not soon be forgotten. Though of a retiring disposition, his genial demeanour and unaffected kindliness had endeared him to a large circle of friends. The funeral took place at Winchester on Friday last.

TECHNICAL RECORD.

THE ILLUMINATION OF LIGHTHOUSES.

In a previous issue of the JOURNAL, reference was made to a paper read before the Royal Dublin Society by Mr. John R. Wigham, in which he described a large lens he had constructed for use with his gas apparatus for the illumination of lighthouses. The communication was supplementary to one brought before the Society on a previous occasion, when the author briefly explained his new system of lenticular "quadrilateral" arrangement, respecting which he promised further particulars. These he supplied in the following paper:—

The original lens designed for lighthouse illumination by Fresnel is 3ft. 3in. high by 2ft. 7in. wide; and it was constructed to transmit the light of an oil-lamp, the flame of which was about 3½ inches in diameter by 3 inches high. This lamp originally had three concentric wicks. Another wick was afterwards added; and its illuminating power, when at Howth Bailey gas was first employed as a lighthouse illuminant, was 328 candles. The gas-burners then introduced, and since adopted at Irish lighthouses, represented a very much higher illuminating power than this oil-lamp; and their flames were of much greater dimensions. Each burner could be used in five different sizes and degrees of power, according to the state of the weather, The smallest, which represented in size the Hincks oil-lamp, had a lighting value of 427 candles; the next size, 6 inches in diameter, 832 candles; the next, 8 inches in diameter, 1253 candles; the next, 9½ inches in diameter, 2408 candles; and the largest, the flame of which was 11¼ inches in diameter and about 8 inches high, had an illuminating power of close upon 3000 candles. This great power was capable of being augmented two, three, or four times by the superposition of one, two, or three burners and tiers of lenses, called the biform, triform, and quadriform system; its effect for lighthouse illumination being capable of still further enhancement by the automatic extinction and re-ignition of the gas—forming the "group-flashing" system. The light from the whole of these burners was originally transmitted through the Fresnel lens, having a focal distance of only 920 millimetres; and although the practical effect of the higher illuminating power of the gas-lights in increasing the power of the beam from the lighthouses where they were employed was very marked, it was evident that a considerable portion of the light from the larger sizes of the gas-burners was ex-focal, and did not give a beam of anything like the power which the greater size of the luminary would produce if used in conjunction with lenses proportional to the dimensions of the burners. The great advantage of lighthouse illumination from the introduction of the gas system arose from two causes: (1) The greater illuminating power of the flame, which increased in proportion to the greater diameter of each burner; and (2) the diffusion of ex-focal light, which illuminated fog to an extent never before seen in lighthouse illumination.

To me it was a self-evident proposition that, if lenses were constructed of suitable size and of suitable focal distance for the large-sized flames obtainable from gas, we should not only have an enormously increased focal light, but we might also have it with still greater diffusion of the useful ex-focal light to which I have referred. Twenty years ago I gave expression to this opinion, and urged that lighthouse authorities would do well to have such lenses constructed in order to do full justice to the gas system which had been inaugurated in Ireland. At the meeting of the British Association in 1878, and again before that body in 1881, and at the Institution of Civil Engineers, London, in 1879, and the Royal Society of Arts, London, I brought under public notice the advantages which would result from the employment of such lenses. In 1885, a step in advance was taken by the Commissioners of Irish Lights on erecting at Mew Island Lighthouse, in the Belfast Lough, lenses 4 feet high by 3 ft. 7 in. wide, but still with the 920 mm. focal distance.

After the South Foreland experiments had taken place, Messrs. Stevenson, the Engineers to the Board of Northern Lighthouses, obtained the sanction of the Board of Trade to the purchase from the eminent firm of optical engineers, Messrs. Barbier and Co., of Paris, of a much larger lens for experimental purposes. This lens had a focal distance of 1330 mm. Messrs. Stevenson called it a hyper-radiant lens. It was tested by them and the experts of the Trinity House; and according to their report, it was found, when used in conjunction with large burners, to have practically double the illuminating power of any lens previously made—a significant pronouncement of enormous importance. Messrs. Stevenson's report states their opinion that the use of such lenses would so much increase the light as to render unnecessary the application of the biform, triform, or quadriform arrangements. For this they gave no reason; but their idea evidently was that when, by the use of this large lens, they obtained as much light as would be given by the superposition of smaller lenses, they had accomplished all that was necessary. My ideas were not thus limited, nor did it strike me as desirable that the illuminating power of lighthouse lights should be restricted to the maximum advised by Messrs. Stevenson.

Having so long advocated the use of such lenses, and being so thoroughly convinced of the advantages that would result

from their adoption, I lost no time, as soon as the pronouncement in their favour was made by Messrs. Stevenson and the Trinity House, in proposing to the Commissioners of Irish Lights that, if they would adopt these lenses at Tory Island, instead of the lenses of the Mew Island type, which, according to their instructions, I was about to erect there, I would make, without any charge to them, the alterations to the lantern, &c., rendered necessary by this change. The Commissioners, fully alive to the advantages of the new system, assented to this proposition; and they thus became the first lighthouse authority practically to adopt it. Further, notwithstanding the opinion of Messrs. Stevenson, that the light should be restricted to a single tier of lenses, and in face of strong letters to them from the Board of Trade, urging that it was inexpedient to adopt any higher optical power with these lenses than biform, they determined, and adhered to their decision with a persistence worthy of all praise, to place these lenses at Tory Island in triform. The wisdom of this course has been abundantly justified by the most conclusive testimony from the commanders of ocean steamers and others as to the advantages to navigation which have arisen from the establishment of that triform light.

While it was to me a matter of rejoicing that such large lenses should be made and placed at so important a lighthouse as Tory Island, and that the adoption there of 1330 mm. focal distance lenses was so successful, I still held that, though a great advance had been made, it was not by any means all that could be accomplished. It seemed to me that there was no reason why still larger lenticular surfaces should not be used for lighthouse purposes with very great advantage; and I therefore proposed that lenses having a focal distance of (say) 2 metres, should be made so that the whole of the light from a 12-inch gas-burner might be utilized and transmitted to the mariner. I accordingly consulted with Messrs. Barbier, who entirely agreed with me as to the practical utility of such lenses, and the feasibility of their construction. They had heard, as we had all heard, that Lloyds and the great American steamship companies had expressed a desire that a particularly powerful light should be placed at the Old Head of Kinsale; and, at my request, they designed and made a lens suitable for such a purpose. It may well be called "The Giant" lens, for it is by far the largest lens ever made; and when it was erected in Messrs. Barbier's workshop in Paris, it caused considerable sensation as a most remarkable work, and likely to effect a revolution in lighthouse illumination. [The author showed one of the lenses.] I think you will agree with me that it is not only a splendid specimen of manufacturing skill, but a perfect work of art; reflecting the greatest possible credit upon Messrs. Barbier, its designers and constructors. The axial intensity of the lens is 800,000 candles.

Each face of the apparatus measures 10 ft. wide by 22ft. 6in. high; and the resultant beam is calculated to be equal to 5,000,000 candles. The apparatus is not of such size as could not be conveniently accommodated on a lantern of reasonable dimensions, such as might be placed in any lighthouse tower. The apparatus is only 14½ feet in diameter, requiring a lantern 17½ feet in diameter. In triform, the axial intensity is 2,400,000 candles, or 2½ times that of Tory Island. The duration of the flash would be six seconds, recurring every minute. With the new "intensity" burner, which is now lighter in the focus of the lens, the light would be five times the power of that of Tory Island. It is to be observed that, in this calculation, allowance has not been made for the fact that the lens, owing to its peculiar spherical form, will internally return to the flame the whole of the light reflected at the first refracting surface, so as to increase the amount of light emitted directly from the flame towards an opposite panel, which light in the case of the ordinary plane lens is wholly lost. Every part of the lens has been most carefully ground, so as to refract or reflect the light from the large gas-burner I have placed in its focus.

The great interest that attaches to this lens at the present time is that its appearing now is most opportune, because of the dissatisfaction of the French lighthouse authorities with the performance of the electric light as a lighthouse illuminant. The electric light has been applied at some of their lighthouses for many years, and they had intended to apply it to many more; but the complaints which have reached them have induced them to alter their determination. Hence the engineers of the French Lighthouse Department are naturally looking for a substitute; and it is for this reason that this new lens has excited so much interest in Paris.

We are, of course, all aware that the electric arc light is by far the most intense artificial light which has ever been used for lighthouse purposes. I have experimented much with it. In clear weather its power is enormous. I have read *The Times* at Salthill by the electric beam directed from the Experiment House at Howth Bailey; but I found, as has since been also found in actual practice by seamen and others, that, as the weather became foggy, this enormous light diminished far more rapidly than did the light of an ordinary oil or gas lamp, and that these latter lights remained visible after the electric light had been entirely extinguished by the fog. The Shipmasters' Society, in a letter to the Trinity House, dated March 7, 1891, say: "Many members of this Society, in active service, frequently passing from the Thames to the sea, and *vice versâ*, have often represented the poorness, sometimes invisibility, of electric lights during certain conditions of hazy atmosphere, at times when the oil lights of lightships, &c., and the gas lights of seaside towns have been comparatively bright and distinct." They continue: "Again, complaints have been made of the intense and blinding effects produced on navigators by electric lights such as the South Foreland on vessels in its immediate vicinity."

The reports from the United States are also unfavourable to the electric light as a lighthouse illuminant, and show that its use has been actually given up there. The New York *Electrical Review* says that "the lighthouse officials have given up the idea of using electric lights in lighthouses. The electric light, which was established for the purpose of testing its adaptability to the service, proved so unsatisfactory to navigators, and brought such earnest protests from shippers, that it was abandoned." Thus it would seem that the electric light as a lighthouse illuminant is unsatisfactory to British seamen, that in France its progress has been arrested, and that in the United States of America its use has been absolutely abandoned.

The lens at which we are working may be regarded as the farthest development on a practical scale of the principle of quantity or volume, in contradistinction to intensity, in the light used for lighthouse purposes. The electric light—the highest example of intensity—has put forth its greatest effort at St. Catherine's Point, Isle of Wight. Its 6,000,000 or 7,000,000 candles have there full play, with what effect the nautical portion of the community, in view of the stranding of the *Eider*, and the correspondence which has arisen thereupon, have been seriously considering. This new lens and its large gas-burner will enable the advocates of volume to show what they can do. The maritime public are watching the contest with much interest, as human lives are involved in the issue; and although some may say that victory is already on the side of the larger, but less intense illuminant, and that the electric light has been tried and found wanting, the other side has not yet been allowed to show what the full power of gas and large lenses can do to fill the place which it was fondly hoped the electric light would occupy.

The Commissioners of Irish Lights have decided to allow this great lens to be erected in the Experiment House at Howth Bailey for the purpose of practical trial; and we may hope that, with that wisdom which they have shown on former occasions, they will again take the lead in this matter, and give to the mariner the full benefit of this latest development of lighthouse illumination. The experiment will be one of much interest. In fine weather, of course, the large lens will completely outshine its powerful neighbour, the ordinary light of the Baily Lighthouse; and should foggy weather intervene during the experiments, it will, I think, be found that, long after the Baily light, even at its highest fog power, is lost to view, the light from our "Giant" lens will still assert itself.

THE DETERMINATION OF SULPHUR IN COAL.

In the JOURNAL for Jan. 19 last (p. 111), some particulars were given in regard to the method proposed by M. Eschka for determining the quantity of sulphur in coal; and they were supplemented in the following number by others contributed by Mr. Norton H. Humphrys. A recent issue of the *Chemical News* contained a translation of an article on the subject sent to the *Chemiker Zeitung* by Dr. F. Hundeshagen. Eschka's method, it may be remembered, consists in burning the coal or other fuel in in presence of sodium carbonate and magnesium oxide. Dr. Hundeshagen recognizes that a serious error may manifest itself in the application of the process, in consequence of the production of gaseous sulphur compounds which escape condensation by the reagents employed. This loss, which may reach 6 per cent. and more of the total sulphur, is essentially due to formation of sulphuretted hydrogen. He says we may escape this loss entirely, or almost entirely, by substituting in Eschka's mixture potassium carbonate for sodium carbonate. He finds that a mixture of one part of dry potassium carbonate with two parts by weight of magnesium oxide is most advantageous in all places. If we increase the proportion of potassa, the mass becomes fritted at a red heat, and the combustion of the coal is impeded. To one part of coal are used at least two parts of the above mixture; three-fourths of the reagent are intimately mixed with the finely-powdered coal, and the remainder is spread at the top. The combustion proceeds more rapidly than with the soda mixture, and is generally completed in from a quarter to half an hour.

The inconvenience of Eschka's mixture is due in the first place to the property of sodium carbonate to become completely dehydrated at a low temperature, and to possess in this state only a very feeble power of absorbing sulphuretted hydrogen, &c.; and, further, sodium sulphide is easily decomposed by moist carbonic anhydride. The advantages of potassium carbonate lie in its power of fixing water even at a rather high temperature, and of reacting with sulphuretted hydrogen to form potassium hydrosulphate with an escape of carbonic anhydride. This absorption of sulphuretted hydrogen is promoted by the fact that potassium carbonate, intimately mixed with magnesia, reacts partially with it, under the action of watery vapour, to form potassium hydroxide, the absorbent capacity of which for

sulphur compounds is much superior to that of the carbonate. Sodium carbonate does not possess this property, or at least only in a very slight degree. One may easily demonstrate the difference of action of the two alkaline carbonates with sulphuretted hydrogen. Sodium carbonate mixed intimately with a slight proportion of sodium sulphide and bicarbonate, or with ammonium sulphide, gives off a considerable quantity of sulphuretted hydrogen, especially if exposed to heat; while a very small addition of potassium carbonate, if intimately incorporated with the other ingredients, completely prevents this escape.

REGISTER OF PATENTS.

Liquid Meters.—Greenhill, M. C., of Tulse Hill, S.E. No. 17,545; Oct. 14, 1891.

The object of this invention is to produce an appliance for measuring the flow of liquids, or free-flowing substances contained therein (sewage matter, for instance), such as may be delivered from a main source of supply to the apparatus. The apparatus, which is automatic in action, consists of a receptacle containing two divisions, supported on pivots or axles at its lower portion, in such a manner as to be capable of oscillation. By adjusting the point of the pivotal supports relatively to the receptacle, the latter is adapted to oscillate (within a given arc), so that the length of the arc may be varied to suit the amount of liquid passed at each oscillation. Liquid is admitted to each division alternately; and by valves it is discharged at each oscillation—the number of oscillations or volumes of liquid being recorded on the dials of a suitable counting device. The receptacle is mounted within a casing, having steps or bearings for the pivots or axles; and the tank may also connect to the liquid supply and discharge pipes.

Gas-Engines.—Weyman, J. E., Hitchcock, G., and Drake, J. A., of Guildford. No. 18,640; Oct. 29, 1891.

The object of this invention is to prevent the over-heating and undue expansion of the pistons of gas-engines, in contact with gases of high temperature, by protecting the surfaces of the pistons with non-conducting material—such as asbestos, silicate of cotton, or other non-conducting material or compound. In some cases, this protective material is attached to the end of the piston by a plate or cover attached to the body of the piston by set-screws or bolts, in such a manner that the non-conducting material forms a protective pad or washer to the body of the piston. In other cases, the pistons are so made that the ends which come in contact with the heated gases are open or hollow, so as to form a space into which the non-conducting material may be pressed. Then, by chamfering the inner edges of the piston, and allowing a portion of the non-conducting material to project beyond the end of the piston, a very small proportion of the metallic surface of the piston would be exposed; and even this portion, when necessary, may be protected with a metallic ring or cover, attached to the body of the piston by screws or bolts.

Gas-Taps.—Pain, A. C., of Edgbaston. No. 19,650; Nov. 13, 1891.

This invention relates to an attachment for a gas-tap in order to control the gas supply and the flame when the operator is at a distance away. This is effected by drilling a hole in the end of the gas-plug so as to pass through the gas-supply hole; and into this hole is fitted a sliding pin, preferably formed with a conical end fitting into a seat or cone terminating the hole. Upon the end of the gas-plug is mounted a cylindrical case to serve instead of the usual washer common to gas-taps, and to contain a spring to press the pin to its seat; the pin carrying a projection of reduced diameter, which passes through a cover fitting the end of the case. A washer fits the reduced part, and is pressed home to the shoulder by the spring acting between it and the cover; and in this manner the pin is pushed home. The end of the reduced part is screwed and projects through a hole in the cover, and carries a milled head nut, and an eye outside the milled nut; the former being used to withdraw the pin in order to leave a clear gas passage, or to adjust the aperture by which the gas can flow to the jet. A cord is attached to the eye, and connected to any suitable spot at a distance from the cock—attached by a spring to some fixed point, as described in patent No. 3021 of 1891.

The action is as follows: The gas-cock is turned on to the desired point, and the screw nut adjusted to permit of the requisite pilot flame; and when light is required, the operator, by pulling the cord, is enabled to obtain any desired amount of light, as the two springs counteract each other, so as to leave the regulating-pin in any position in which it may be placed.

Starters and Antifluctuators for Gas-Engines.—M'Ghee, G., and Burt, P., of Glasgow. No. 19,086; Nov. 5, 1891.

According to the part of this invention relating to the starting of engines, the patentees propose to allow the chamber behind the cylinder piston to be charged with explosive mixture at atmospheric pressure, by means of moving round the fly-wheel, so as to cause the piston to inhale the mixture by a special or the ordinary port or ports, during about the first half of the impulse or igniting stroke. The mixture is ignited by a small charge of gunpowder, percussion cap, detonator, or other equivalent means, by a priming orifice, or an ordinary pistol or revolver. By means of gearing, the gas or inlet valve may be made to automatically open to the igniting stroke of the cycle; and the igniting revolver may be similarly actuated, as also by hand. Otherwise, the mixture may be ignited by opening a cock on the hot igniting tube, so as to allow the mixture to touch an incandescent part of same; or otherwise, by means of a naked light placed at the orifice of the opened pet cock.

The antifluctuating device consists of a cylindrical or other shaped metal drum or case, having on one end a flexible diaphragm, from which is suspended a conical or other throttling valve working in the gas-inlet. The inhalations of the engine suck the diaphragm inwards, which allows the valve to open; but when the gas presses out the diaphragm, it shuts the gas-inlet, and thus tends to equalize the pressure of gas in the mains.

Gas-Lamps.—Holman, S., of Westminster. No. 19,963; Nov. 17, 1891.

The principal object of this invention is to provide means whereby lamps having closed lanterns or globes, or which are so situated that the burners cannot be conveniently reached for lighting, can be lighted from the exterior, or from below. The invention also includes an arrangement by which, when several lights are used, some of them can be left burning while the others are extinguished, and all the operations be performed by the same gas-cock.

The patentee provides in the pipe by which the gas is conducted to the burners, or in a special pipe or passage leading thereto, small openings or perforations, extending in a series to the burners, from the exterior of the lamp or other place at which the light is to be applied; and these perforations are supplied with gas when the gas-cock is partly turned to supply gas to the burners. On a light being applied, the issuing gas is ignited and the flame ignites the gas issuing from the succeeding perforations, and so on, until the burners are reached and the gas issuing therefrom is ignited. The cock is now turned to a further extent; and by this operation, the gas is shut off from the perforations, while at the same time it is more fully turned on to supply the burners. In a drawing accompanying this specification, the inventor shows the arrangement applied to a lamp with three burners, which can all be kept alight, or two can be extinguished while one is kept burning. There is also an arrangement for effecting the lighting of the gas in the manner described—the perforations through which the gas passes are formed in a tube separate from that which supports the burners, and in an outward extension from the gas-cock. The opening and closing of the perforations, or of the gas supply thereto, may, for example, be effected in this way: Two tubes, one inside the other, may be perforated so that the perforations in both tubes coincide with each other at the required times; and in this case, one of the tubes may be that which supplies gas to the burners.

Manufacture of Gas.—Lake, H. H.; communicated from W. H. Harris, of Boston, U.S.A. No. 20,420; Nov. 24, 1891.

The main object of this invention is to generate gas from bituminous coal and steam and air supplied thereto to promote combustion, the products of which are suitably mixed and form a fuel gas or low power illuminating gas. Another object is to enrich the gas to any desired degree suitable for illuminating purposes, by adding to it hydrocarbon, which is also converted into gas in the process.

The coal is preferably fed in at the top of a generating chamber kept gas-tight in the following manner: A bell is suspended upon a chain over a drum, which can be operated by a hand-wheel to lower the bell sufficiently to allow coal to be fed in the ordinary manner. The air for promoting combustion is supplied through a series of tuyeres, by means of a pump or fan. In order to prevent the bridging of the mass of fuel, and the formation of clinkers, there is sometimes mingled with this air a small quantity of steam supplied by a series of pipes having a connection with each of the tuyeres, and regulated by separate valves. The generator is kept supplied with a sufficient body of coal, and a requisite quantity of air, to maintain the incandescence of the bottom portion of the charge; while the upper portion is maintained at a glowing heat. The charge of coal reaches to a small distance below the steam-pipe—preferably from 3 to 4 inches. By reason of this large body of coal and a small body of incandescence, the incandescent gases generated are caused to pass through the heated body of coal above, so as to be enriched by the carbon in the body of the charge and by the hydrogen of the steam introduced at the base with air to form the blast. Only a sufficient quantity of steam should be introduced through the tuyeres to prevent clinkering, and not enough to deaden or slacken the combustion.

Another steam-pipe is used, for supplying additional quantities of hydrogen and oxygen. This steam may be superheated by passing through a coil of pipe, which surrounds the upper end of the generating chamber, or in any other convenient manner; the quantity of superheated steam admitted above the charge of coal being regulated by a valve. The steam thus admitted strikes the bricks, but does not strike the coal or coke at the top of the charge; and it does not slacken the combustion or generation of gases to nearly so great a degree as when it strikes the glowing coal or coke. This is because the charge of coal is not incrusted, and the bricks retain a greater amount of heat than the same area of coke; also, because the glowing mass continues to give off its heat to the superheated steam introduced above the mass and to the walls of the generator. These gases are carried off by an up-take flue.

In order to thoroughly mix the gases and convert them into a fixed form, it is necessary to keep them at a high temperature for a considerable length of time, and subject them to frictional resistance which will cause a thorough mingling of the currents while in a heated condition. For this purpose, a continuous regenerating chamber is provided, preferably of serpentine form, filled with a series of balls, composed of refractory material capable of resisting a long continuous high heat—such as silicate of alumina, or material from which fire-brick is made. The patentee asserts that he has found, by experience, that when the regenerative agents are formed of brick or other plain-faced objects, there is a much greater tendency for the deposition of carbon than when the substances are made round, so as to not form pockets, but curvilinear flues or passages; and in order to present as much heating surface as possible, these balls are made approximately spherical. The gas and products of combustion are caused to pass through the series of serpentine chambers, and to discharge through the flue into a condenser for cooling; whence the gases are taken and washed and purified in the usual manner.

If it is desired to make illuminating gas, it is only necessary to enrich the gas as generated, by introducing crude oil or other hydrocarbon through a pipe into the regenerating chamber; so that any desired degree of richness of illuminating gas may be obtained.

It is necessary, in starting the apparatus, to raise the regenerative

chamber and the regenerative balls to a high degree of heat before the gas can be saved for consumption. At the initial starting, there is a deposition of carbon in the regenerating chamber, which must be removed by supplying air and converting the carbon into a gas by combustion. This is accomplished by means of air-supply pipes, provided with valves and connected with chambers or passages, in which are blow-off pipes with regulating-valves attached; so that when the valves are open, the air enters through the pipes, passes through the regenerating chamber, ignites the carbon, and the products of combustion escape through the blow-off pipes. The operation of igniting and blowing off the carbon is continued until the regenerative chambers and balls are raised to a sufficient heat to prevent the accumulation of carbon deposits; so that the entire product of gas produced in the generator is also subject to contact with the mass of balls in the regenerative chambers; which causes a thorough reunion of these gases and a formation of fixed oxy-hydrocarbon gases.

By maintaining a large mass of fuel in the generating chamber, kept at a glowing heat, through which the gases produced by the incandescence are caused to pass and mingle with the gases generated from the mass of coal above the point of incandescence, and by the admission of steam above the glowing mass without the addition of hydrocarbon, a good fuel gas is said to be formed; and by admitting hydrocarbon in the regenerating chamber, which is united with the gases generated from the coal and steam, a good illuminating gas is produced.

The mode of operation is as follows: Kindling is placed upon the hearth of the generator and ignited. The bell is then lowered and a small amount of coal fed in until there is a sufficient body, when more coal is added and the blast started. The bell is then raised to form a seal; and the air and blow-off pipes are opened occasionally to force combustion in the regenerative chamber. This is continued at intervals, until the regenerative chamber is raised approximately to a white heat, when the plant is in condition for the generation of gas for storeage.

The patentee claims that an important part of his invention consists in conveying hydrocarbon into the regenerative chamber, as the supply-pipe then does not become unduly heated, and consequently the hydocarbon is introduced in a liquid form. If the pipe should be placed so as to become unduly heated before tapping the regenerative chamber, the hydrocarbon would be decomposed and carbon deposited in the end of the pipe, which would clog it up. But, by introducing the hydrocarbon in the manner described, no appreciable deposits of carbon are obtained in the pipe. The regenerating chamber has a pitch or lean forward from the point where the hydrocarbon is admitted; so that, in case it is not all immediately volatilized, it will pass down the regenerative chamber and be mixed with the other gases as it is volatilized.

An important result is accomplished by the process described—viz., all the heat produced by the incandescence of the fuel is utilized, not only in the generation of gases, but is also imparted to the gases, which in turn impart the same to the regenerating chamber and its agents. Thus a continuous process of generating gas from coal and superheated steam, and regenerating the same, is carried on; and all the volatile products of combustion are utilized by being converted into gas. The ordinarily non-volatile parts of the coal are rendered volatile by being raised to a point of incandescence in the charge; and as a major portion of the steam enters to enrich the gas impinged against the heated wall in the generator above the body of the coal, the fire is not slackened. Consequently, a much higher degree of heat is maintained, the author claims, within the generator than in some other forms of generators hitherto employed; and the gases are passed into the generating chamber at a high degree of heat. The steam introduced above the charge, being superheated, enters with great velocity, and assists the draught without deadening or slackening the heat in the generator. Thus the regenerating chamber can be used continuously for fixing gas, without the necessity of employing two regenerating chambers and using them alternately.

APPLICATIONS FOR LETTERS PATENT.

17,484.—JENSEN, P., "Working up organic fibrines of large and hardened form for the purpose of procuring tar, oil, paraffin, asphalte, pitch, heating and illuminating gases, and large coke." A communication from H. Stiemer and M. Ziegler. Sept. 30.

17,501.—ROSS, W., "Water-waste preventers." Oct. 1.

17,519.—WESTWOOD, W. H., WRIGHT, E. T., and WESTWOOD, W. W. S., "Washers for washing gases." Oct. 1.

17,540.—LANE, H., and PULLMAN, J., "Valves for controlling the inlet and outlet of compressed liquefiable gases to and from metallic storeage cylinders or vessels." Oct. 1.

17,551.—MACKENROT, C. A., "Mains for gas or liquids." Oct. 3.

17,633.—OVENDEN, P., and BUNKER, H. E., "Water-pipes." Oct. 4.

17,657.—CARPENTER, S., "Hydraulic main cleaner for gas-works." Oct. 4.

17,786.—GRATRIX, S., jun., and BROTHER, Ltd., and BROCKLESBY, H., "Gas-jets." Oct. 6.

17,828.—THOMPSON, W. P., "Lighting lamps, lanterns, gas-jets, and the like." A communication from B. H. Pendleton. Oct. 6.

17,978.—SPRINGER, T. G., "Manufacture of illuminating gas from water and fluid hydrocarbons." Oct. 8.

Australasian Gas Association, Limited.—In the report to be presented at the fourth annual general meeting of this Association to be held to-day, the Directors state that there is a profit of £4633 on the year's working. In March last they declared an interim dividend for the six months to Dec. 31, 1891, at the rate of 7 per cent. per annum; and there is now a balance of £1684. They recommend a dividend at the rate of 5 per cent. per annum, free of income-tax, for the second half of the year ending June 30 last; making 6 per cent. for the twelve months. This will absorb £1465, and leave a balance of £219 to be carried forward. Since June the Directors have acquired the undertaking of the Northern (Melbourne) Gas Company upon very favourable terms; and negotiations for the acquisition of other gas-works are in progress.

CORRESPONDENCE.

[We are not responsible for opinions expressed by correspondents.]

Tar Pavement.

SIR,—This subject is much "in evidence" at present, since Mr. Tobey's paper was read and discussed at the North of England Gas Managers' Association's recent meeting at Seaham Harbour. I was unable to accept the President's (Mr. Whyte's) invitation to attend, so shall feel obliged if you will allow me space in the JOURNAL to say a few words on the subject.

I have seen miles of tar pavement laid at the Antipodes, under a blazing sun, and no sign of feet sticking, or of softening, even on the hottest day; and this was accomplished without any special preparation of either tar or material, as many seem to think is necessary. Ashes do not make good pavement; and coke ground to breeze, or coke in any form, would be the last material I should think of using for such a purpose. The harder the material, the better; and nothing that I know of suits better than the refuse from stone-breaking machines, or granite quarries, where blocks and setts are made. The former was used in Adelaide, Melbourne, and Sydney; the latter I use here in Montrose, mixed with tar direct from the tar-well. I think I can show as good a piece of pavement as needs be, which for three years has retained its surface the same as the first day it was walked upon. When properly mixed, this material sets so quickly that a very heavy roller is required to put a smooth face on it. Water is used to work up the face, and prevent the roller from lifting the material.

While in the Adelaide Gas-Works, the coal-sheds were laid in this manner; and it would be interesting if Mr. Rae, the Manager, when he sees this, would say how the floor stood the heavy coal traffic. I laid down a coal-shed floor here last summer, which is at present covered with coal to a depth of 16 feet; but before the year is out, I will see how it is to stand.

I shall be pleased to give further particulars of this pavement, or to show any gas manager who may visit Montrose the pavement itself. I also laid two years ago a coke-floor in my yard without any foundation. It was only 2 inches deep; and all last winter we worked on it without altering its surface in any way. We get granite chips very readily here; and the pavement for footpaths can be laid for about 2s. a yard. The weather has no effect upon it; and so soon as it is laid and rolled, the traffic can be allowed on it at once. Of course, there is a method, or rather a "wrinkle," in the mixing. This is not a patent, that I know of; and I shall be pleased to instruct anyone who would like to know.

Montrose, Oct. 14, 1892. THOS. D. HALL.

Mr. Gadd's Mechanics.

SIR,—If, as Mr. Gadd asserts, your readers desire proof of the dubious character of his mechanics, they may find it in abundance in the undermentioned back numbers of the JOURNAL.

In the JOURNAL for July 8, 1890, will be found "Mr. Gadd's mechanics," as applied to the construction of his patent gasholder. The principles therein set forth were shown to be erroneous by Mr. Cripps in the JOURNAL for July 15, 1890, in an article entitled "A Criticism of Mr. Gadd's Gas Institute Paper." Much correspondence followed, in which Mr. Gadd endeavoured to uphold his theories, but without avail. Mr. Gadd thereupon wrote an article entitled "A Review of a Criticism," in the JOURNAL for Sept. 16, 1890, followed by another on Oct. 7, 1890. Both these articles are literally teeming with errors. The errors are exposed, and thoroughly *proved to be errors*, in Mr. Cripps's "Rejoinders," entitled "The Gadd and Mason Gasholder" (see JOURNAL for Nov. 4 and 11, 1890). Since that time Mr. Gadd has made sundry attempts to explain away, or twist, his early writings on the subject into meaning something else—as witness his paper in the JOURNAL for Dec. 9, 1890, and the subsequent discussion (see JOURNAL for Dec. 23, 1890) in which he declared "there was no real difference between himself and Mr. Cripps!" Mr. Gadd's Gas Institute paper this year (if it proved anything) proved that he was still very sore over his defeat. Mr. Livesey's letter, calling attention to its deficiencies, brought forth an article from Mr. Gadd entitled "Gasholders without Upper Guide Framing" (see JOURNAL for Aug. 9, 1892). This article was anything but what Mr. Livesey desired, as he subsequently informed Mr. Gadd in a letter to the JOURNAL for Sept. 20, 1892. The correspondence in which I have been engaged with Mr. Gadd is too recent to need recapitulating.

I am content to point out what I know to be errors in Mr. Gadd's paper, so as to prevent beginners, and those but imperfectly acquainted with mechanics, being led astray. Having done this much, I think the foregoing synopsis will form a fitting conclusion to the correspondence on the subject.

Sept. 15, 1892. R. J. MILBOURNE.

P.S.—If Mr. Gadd can mention the names of three engineers well versed in the subject of mechanics and the determination of strains in structures, who after reading the articles above referred to, will still desire further proof of the erroneous nature of Mr. Gadd's mechanics, I shall be very pleased to give any proofs they may call for; but I decline to do so simply for Mr. Gadd's edification. R. J. M.

Making Work Water-Tight Below Water-Level.

SIR,—In the JOURNAL for May 31 last, there is a notice of a communication to the *Engineering Record* on the subject of making water-tight work below water-level. Will you allow me to give, through the medium of your columns, my personal experience of the same class of work? The only difference was that mine was for a gasholder tank 72 feet in diameter, built entirely of concrete.

The Blenheim Gas-Works are situated on the banks of a shingle-bearing river, called the Omaka; and the site of the tank was 70 feet from the stream. The strata were 8 feet of soil and 16 feet of loose water-bearing shingle. The depth of the tank, including foundations

was 24 feet; the tank foundations were 9 feet below the ordinary river-level, and 16 feet below the ordinary flood-level. My first proceeding was to sink a well or sump 3 feet below the foundation of the tank, and in connection therewith. In this well I placed my pumping gear. Having secured the drainage, and the excavation being done, I put in the foundations in the ordinary manner; making the moulds as nearly water-tight as possible under the circumstances. After filling, I allowed the water to remain stationary—giving the concrete ample time to set; and I continued the same process until my work was well above the water-level. I then pumped down, and found innumerable leaks in the foundations and walls of the tank. To overcome this difficulty, I had holes drilled through the foundations and walls at intervals, and in these I inserted tubes from 1½ to 2 inches in diameter; caulking them firmly with cement. By this means I relieved the outside pressure, and caused the water to flow through the tubes, and from thence to the sump. After allowing a reasonable time for the concrete to dry, I put on two coats of cement plaster (2 to 1); finishing with a thin coat of pure cement. The whole was well keyed into concrete, and finished up smooth with the trowel. To make my tank thoroughly water-tight, after everything was properly set, I filled up the tubes with cement mortar, and screwed a plug or collar on the end of each; covering the whole with cement mortar. It is now five years since this work was finished; and it is perfectly water-tight.

Blenheim (N.Z.) Gas-Works, Aug. 23, 1892. J. MUIR.

The Electric Light in Carlow.

SIR,—In regard to your reference to this matter in the JOURNAL for the 4th inst., I may say that there is no truth whatever in the statement that the Carlow Gas Company issued a circular to the inhabitants of Carlow, informing them that "any person using electric light would be at once cut off from the gas-mains." No such circular was issued, or any order to that effect. A few persons using electric light, and who had ceased to use gas, were served with notice that their meters would be removed; but this they refused to allow—it being very useful to have the gas when the electric light goes out, as it does very often. For instance, it was out for half an hour on the 13th inst. The electric light is on only from sunset until 12 o'clock p.m. I may add that 14 out of 203 consumers have taken in the electric light on trial; and this is the extent of the success of the Electric Light Company in Carlow.

The Carlow Gas Company are under Deed of Settlement, and not under Act of Parliament; and they are therefore in no way bound to leave meters with non-consumers, except by courtesy.

EAMES ROGERS, Secretary,
Carlow, Oct. 14, 1892. Carlow Gas Company.

LEGAL INTELLIGENCE.

SOUTHERN DIVISIONAL POLICE COURT, DUBLIN.

Thursday, Oct. 6.

(*Before Mr.* SWIFTE, *Divisional Magistrate.*)

The Dublin Corporation v. Alliance and Dublin Consumers' Gas Company—The New Gas-Testing Station.

In this case, a summons was issued at the instance of the Dublin Corporation, who complained that in June last the Gas Company commenced the erection of a building of the warehouse class—viz., a new gas-testing station in Tara Street, without giving due notice of the intended erection to the complainants as the sanitary authority, or delivering any plans and sections, showing the position of certain parts and appurtenances of the building, to wit, the chimneys, chimney breasts, and chimney flues, on the ground and first floor, nor any description in writing of the materials of which it was intended that such parts and appurtenances of the building should be constructed, as required by the Corporation bye-laws.

Mr. M'INERNEY appeared for the complainants; Mr. W. KENNY, Q.C., M.P., for the defendants.

Mr. M'INERNEY said this was a summons under bye-law 94 of the Public Health Act, which said that every person who should intend to erect a building should give to the sanitary authorities notice in writing of such intention, and should at the same time deliver or send to the Town Clerk plans and sections of the intended buildings, and a description in writing of the materials of which it was intended that the building should be constructed; and the surveyor of the sanitary authority should within fourteen days signify whether he approved or disapproved of the plans. There had been a long-standing dispute between the Corporation and the Gas Company as to the gas-testing station; and the point the Corporation officials always made was that they could not carry out the proper testing of the gas, owing to the overheating of the place and the interference of people living in it. Accordingly, after an arbitration, it was decided that they should erect a new testing-station; and plans, without any chimneys, were lodged with Mr. Harty, but having, in accordance with the provisions of the arbitration, means for heating the testing-station by flues connected with a boiler in the basement story. Gas could only be tested at a certain temperature; and the heating by hot water was a self-adjusting one, which would not go beyond a proper temperature, and all the testing-stations were now heated in this way. When the plans were lodged, the idea that was in the minds of both parties was that it should be done, in accordance with the arbitration, by hot water; and the plans showed no chimneys. Afterwards the Gas Company proceeded to build; and as soon as the Corporation found they were building chimneys, they called their attention to the fact, and asked them to stop. What the Corporation now complained of was that no plan of these chimneys and no description of the work had been lodged with them. This was a violation of the bye-law; and they asked for the penalty provided by the section—viz., £5.

Mr. *Spencer Harty*, the Borough Surveyor, deposed that the plans for the new gas-testing station as lodged with him did not show the chimney breasts and fireplaces now built on the first floor. When he found that these deviations were being made, he wrote on Aug. 31 requiring that the work should cease forthwith, and the "objectionable chimney breasts and piers be removed, and the entire station properly carried out under the award and proposed plans." The work was then stopped for a time, but was commenced again. The General Manager of the Company (Mr. W. F. Cotton), in his reply, sought to involve witness in a controversy as to the terms of the award. Witness wrote: "The chimney breasts will interfere with the testing-rooms, &c., inasmuch as they will increase the temperature, and also lessen their capacity and usefulness. They are not on the plans of the award, nor are they shown on the deposited plans already agreed to. The putting of them in was an afterthought, as can be seen by the tracing."

Mr. M'INERNEY said he did not himself think it was an afterthought at all, having regard to all the controversy that was going on. He thought it was deliberately left out of the plans, and put into the building afterwards.

In cross-examination, witness said the Corporation were proceeding as the Sanitary Authority.

Mr. KENNY remarked that the bye-law under which the Corporation proceeded was under section 41 of the Act, which authorized them to make bye-laws with respect, among other things, to the structure and description and quality of the substances used in the construction of new buildings for securing stability, and the prevention of fires, and the purposes of health.

Witness admitted that in none of these matters did the erection at Tara Street infringe the section; and he would not in these respects have brought the summons. But it was applied for because the plans as lodged did not show the flues and chimney breasts now being built. There was a fireplace in the central room in the first storey; it was bricked up, but the brickwork could be removed in a quarter of an hour. He had approved of two flues from the basement from the boiler; but these were not on the plans attached to the award.

Mr. KENNY said the objection of the Gas Company was that the Corporation desired to get a decision from the Magistrate on a point which was the subject-matter of an injunction if they wanted to get the award carried out. Proceeding he submitted that no case had been made for the purpose of getting a fine inflicted. Mr. Harty, who gave evidence in the fairest and most candid way, showed that what the Corporation required was a decision on the construction of the award, with which his Worship in this case had nothing to do; and they wished to get this decision indirectly from the Court. Now, this award, which was dated Dec. 16, 1889, was a settlement of long-standing disputes between the Corporation and the Company. A testing-station existed on Burgh Quay; and by the award a new station was to be erected in Tara Street. This was now being built, and the Gas Company were to spend a sum of £2000 in providing the instruments necessary for the testing; and, of course, to take charge of these valuable instruments, it would be necessary to have a caretaker residing on the premises. A long correspondence took place as to the lease of the premises. The Corporation insisted that the lease which they were giving should provide that the building should be "only" used as a testing-station, and that the rent should be a nominal one of a shilling a year. The Company objected to the word "only;" and at last it was agreed that the word should be struck out, and the rent of the place should be fixed at a shilling a year as long as the premises were used as a testing-station, and that it should be £10 a year if the premises were at any time discontinued as a testing-station. For the purpose of providing for the caretakers, the additional fireplaces were introduced. When the lease was approved by the Treasury, a notice was served on the Company, and the Corporation were advised that under this they were sufficiently protected in the event of any part of the station being used as a dwelling-house. Nothing of the kind was contemplated by the Company. One of the flues was already approved of; and as regards the flue that was now bricked up, he was prepared to give an undertaking that the brickwork would not be removed so long as the erection remained a testing-station.

Mr. SWIFTE asked what Mr. M'Inerney had to say to this offer. It appeared to meet the objections of the Corporation.

Mr. M'INERNEY observed that he, of course, could not speak personally. But there was a member of the Corporation present; and they would be prepared to accept the undertaking and let there be a nominal fine of one shilling inflicted.

Mr. KENNY said the Company would not submit to any fine.

Mr. SWIFTE said he could not impose a fine without looking fully into the case. There might be something in Mr. Kenny's point under the section.

Mr. M'INERNEY remarked that if his Worship would not inflict a nominal fine, he would prefer that the case should go on and that they should be left in their present position.

Mr. KENNY said in that case he must continue the observations which he was addressing to his Worship. It was clear, on the admission of Mr. Harty, that the Corporation were prosecuting there simply in the capacity of Sanitary Authority under the Sanitary Act of 1878; and he submitted that there was no breach of the terms of the Act which would justify his Worship in inflicting a fine. There were three classes of buildings to which the Act applied—public buildings, warehouses, and dwelling-houses—and he submitted that the testing-station did not come under any of these three headings.

Mr. M'INERNEY, replying on behalf of the Corporation, contended that the testing-station was a warehouse, as valuable instruments would be stored there. At all events, it was a building, which was sufficient under the Act. Indeed, the Gas Company themselves admitted that the Act applied by lodging the plans of the place with the officers of the Corporation.

Friday, Oct. 14.

To-day the reserved judgment in the case was delivered.

Mr. SWIFTE, at the outset, expressed his intention of amending the summons by adding a count charging that there had been a deviation by the defendants from the plans as lodged. He then went on to say that the summons seemed to have arisen out of an old-standing dispute

between the parties; and a long correspondence took place between them, showing that the clear intention of both was that the award made by the Arbitrators as to the new gas-testing station in Tara Street should be carried out. Certain plans for that station were lodged by the Gas Company with the Corporation; and on the 31st of August last, the City Engineer (Mr. Harty) wrote to the Company complaining that the plans were being departed from by the erection of chimney breasts and flues, which constituted a deviation from the award, and requesting that the Company should remove these erections, and that the works should be carried out according to the plans lodged and approved. Mr. Cotton, the Manager and Secretary of the Company, replied, assuring the Corporation that they might rest satisfied the works would be carried out conformably to the award. The erections were not removed; and the Corporation issued a summons against the Company for a violation of the building bye-laws. The 41st section of the Act of 1878 provided that the Corporation might make bye-laws regulating the erection of new buildings as regards stability, the prevention of fire, and public health. Mr. Kenny's main contention on behalf of the Company was that Mr. Harty admitted, on cross-examination, that the building in question did not offend in these respects; and he submitted that the summons was really issued to obtain a judgment on the construction of the award, as to which relief should have been sought in the Superior Courts, and that therefore the conviction could not be sustained. According to the contention of Mr. Kenny, a builder might disregard the plans deposited with the Corporation, so long as he did not offend in regard to stability, the prevention of fire, or public health. If that were so, where was the necessity for depositing plans at all? The proper course, to his mind, for the Company to have taken was to lodge supplementary plans, showing the deviations that were made. He was of opinion that the Corporation had established the several grounds of their complaint; but, following a case decided by Justices Denman and Matthew in England, he would add to the summons a count to the effect that the defendants had deviated from the deposited plans. It occurred to him that he would fine the Company 40s., with £6 6s. costs; but he thought if Mr. Kenny would repeat the offer he made on the previous occasion, he would entertain an application for the reduction of the fine to a nominal sum. He thought anything that would have the effect of preventing further litigation between these two highly respectable bodies was very much to be desired.

Mr. M'Sheehy said he repeated the offer his Counsel had made—to accept the terms offered, provided there was a finding of a breach.

Mr. Kenny said, on the part of the Company, he was not then in a position to repeat the undertaking on the new condition—viz., that a fine was to be inflicted on the Company. He formally objected to the amendment of the summons, which, he said, introduced an entirely new cause of complaint; and in the event of the Board of the Company not acceding to the suggestion that they should give an undertaking that these rooms should not be used with fireplaces so long as the building continued to be a gas-testing station, he would ask his Worship to state a case.

Mr. M'Sheehy said that he could not object to this; he would be delighted to have his Worship's able judgment confirmed.

After some discussion, it was decided that, *pro formâ*, in order to save three days allowed by the statute, the defendants should there and then give notice of an application to have a case stated, on which they could afterwards proceed or not, as the Directors of the Company might decide.

The Testing of Gas at Sheffield.—A Committee appointed by the Sheffield Town Council at the beginning of the present year to consider the subject of the testing of gas, have reported upon an interview which a deputation have had with the Chairman of the Gas Company (Sir Frederick T. Mappin, Bart., M.P.), the General Manager (Mr. Hanbury Thomas), and the Law Clerk (Mr. W. Wake). In reply to an inquiry, Sir Frederick stated that the Company would not object to the Corporation tests being taken at the works; but they would object to the tests being taken without the presence of a representative of the Company. The deputation having asked whether the Company would not give up their right to have two hours' notice before an official test is taken by the Corporation, the Chairman answered that they could not. He then gave the average yearly results of tests made by the Corporation Gas Examiner and the Gas Company respectively from 1875 to 1891, which showed that, in most instances, the Company's tests yielded a slightly less illuminating power than those of the Corporation Examiner. The Committee added that they consider it would be more satisfactory to the ratepayers and gas consumers if the Corporation Gas Examiner could make his tests at any time he chose, without giving notice.

Horizontal v. Inclined Retort-Settings.—Some months ago the Engineer and Manager of the Huddersfield Corporation Gas-Works (Mr. W. R. Herring) submitted to a Special Committee of the Corporation a long report on the capacity and condition of the Leeds Road works. Those portions of the report which it was deemed advisable to make public were ordered to be printed; and this has been done. In connection with the carbonizing department of his works, Mr. Herring gives a comparative statement of the cost of increasing the plant to the extent of 144 tons of coal per diem with horizontal and inclined retort-settings respectively. It may be of interest to reproduce these figures, as, it may be remembered, the Committee decided to adopt the latter system. The cost of a complete bench, consisting of 16 settings of eight horizontal retorts 20 feet long, Mr. Herring puts at £7680; and the necessary extension of the retort-house at £3000—together, £10,680. The cost of carbonizing 35,136 tons of coal, at 3s. per ton, comes to £5270 8s.; and the interest, at 4½ per cent. per annum on the capital expenditure, to £480 12s.—making altogether £5751. A retort-bench consisting of 20 settings of eight inclined retorts 15 feet long Mr. Herring reckons to cost £10,500; the foundations for the engine and coal breakers, and attendant expenses, £2000—together £12,500. Carbonizing, at 1s. 8d. per ton, comes to £2928; the interest on the capital expended, to £562 10s.—together, £3490 10s., as compared with £5751; or an estimated saving of £2260 10s. per annum in favour of the inclined retort system.

MISCELLANEOUS NEWS.

METROPOLIS GAS SUPPLY.

The Quality of the Gas in the Past Quarter.

The following is an abstract of the report of the Chief Gas Examiner for the Metropolis (Dr. A. W. Williamson, F.R.S.) as to the quality of the gas supplied by The Gaslight and Coke, the Commercial, and the South Metropolitan Companies, during the quarter ending the 30th ult.:—

I. *With respect to Illuminating Power and Sulphur.*—The averages as regards illuminating power and sulphur at each testing-station were as follows:—

	Illum. Power. Candles.	Sulphur. Grains.
The Gaslight and Coke Company—		
Fenchurch Street, E.C.	16·7	11·4
Cloth Fair, E.C.	16·6	11·7
Dorset Buildings, E.C.	16·7	11·6
Ladbroke Grove, W.	16·4	11·4
Devon's Road, E.	16·2	8·7
Carlyle Square, Chelsea, S.W.	16·2	11·0
Camden Street, N.W.	16·4	11·7
George Street, N.W.	16·3	10·5
Graham Road, E.	16·7	11·3
Kingsland Road, E.	16·5	10·5
Spring Gardens, S.W.	16·4	11·6
Grove Gardens, Regent's Park, N.W.	16·6	11·6
Hornsey Road, N.	16·5	10·8
Lambeth Road, S.E.	16·5	9·4
Millbank Street, S.W. (cannel gas)	21·2	9·1
Commercial Gas Company—		
Parnell Road, E.	16·3	8·4
Wellclose Square, E.	16·3	7·0
South Metropolitan Gas Company—		
Hill Street, S.E.	16·6	11·2
Foster Place, S.W.	16·2	12·8
Stoney Lane, S.E.	16·7	16·6
Lewisham Road, S.E.	16·5	10·4
Burrage Road, S.E.	16·2	15·3
Blackfriars Road, S.E.	16·3	18·7

Returns were received during the quarter of deficient illuminating power in the gas tested by the official examiners at the Cloth Fair, Camden Street, Wellclose Square, Lewisham Road, and Burrage Road stations.

II. *As regards Purity.*—The gas was wholly free from suphuretted hydrogen during the quarter; but the maximum amount of sulphur allowed in the gas was frequently exceeded in the gas made by the South Metropolitan Company. Ammonia was generally present in the gas more or less frequently during the quarter at all the testing-stations; but only in slight quantities. The limit allowed was but once exceeded—viz., at the Blackfriars Road station of the South Metropolitan Company—when it was returned by the official examiner as 5 grains; being an excess of 1 grain.

THE GAS QUESTION IN PARIS.

A Proposed New Treaty.

The position of the Paris Gas Company in relation to the Municipality and the consumers has been frequently discussed in the Journal, the columns of which have contained records of the various movements set on foot in the city with the view of obtaining a reduction in the price of gas. All these attempts, however, have been fruitless; and the Company's Treaty of 1870 remains in force. Although this matter has not been alluded to of late, it is not because it has ceased to engage attention, but rather because it has been deemed advisable to defer further comment until a project calculated to be accepted by the several parties concerned had been formulated and brought into something like definite shape. Such a project is now awaiting the sanction of the Municipality. It is the outcome of prolonged negotiations, initiated by the Streets Committee, which have taken place with the Directors of the Gas Company; and it has been approved of by the Prefect of the Seine. It was submitted to the Council some time ago, accompanied by a long report on the whole question by the Vice-Chairman of the above-named Committee (M. Sauton); but a decision thereon was postponed owing to the action of a body representing a number of small gas-consuming tradesmen, who protested against the matter being settled by the present Council, and asked that it might be left to the Council sitting in 1899 to examine and decide. The fact that, after months of deliberation, the completion of a project having for its object the benefit of the gas consumers should be retarded by the action of a certain section of them, is a striking example of the difficulty of pleasing everybody. It will be singular indeed if their action should be followed by others. But without speculating upon this eventuality, we will give an outline of the draft agreement as finally amended.

According to article 1, from and after the 1st of January, 1893, until the expiration of the existing concession (Dec. 31, 1905), the price of gas to private consumers by meter is to be reduced from 30 c. to 25 c. per cubic metre if used for lighting, cooking, and heating purposes, and to 20 c. per cubic metre if employed for motive power. The last-named price, however, will only be applicable to engines taking their supply of gas through an independent service-pipe and meter; but the Company will supply, free of charge, a special meter for use with engines of less than 1-horse power. The next article specifies that these reductions are not to apply to gas supplied for public lighting, or to any now sold at rates above or below 30 c. per cubic metre. By article 3, the consumers are allowed interest at the rate of 3 per cent. per annum on their deposits; and this will be paid to them at the end of each year for each complete half year that the deposit has been in the Company's hands. The next two articles relate to the loan capital of the Company. The present 5 per cent. bonds are to be converted

into an equal number bearing interest at 4 per cent., the liquidation of which at par (500 frs.) will take place annually during a period not exceeding 25 years from Jan. 1, 1906. The repayment of this capital, with the interest thereon, will be a charge upon the City of Paris, supposing the Municipality should undertake the supply of gas on their own account in 1906; and in the event of the contract being transferred from the Company to some new concessionaire or directorate, the City will still be responsible for the reimbursement of the bondholders. Any new bonds which may be issued before the expiration of the present concession, will be paid off under the same conditions as those applying to the converted bonds. It is specified that the suspension of the amortization of the loan capital from 1893 to 1905 is not to affect the division of the Company's property at the close of the existing contract, nor diminish the share thereof to which they would have been entitled if the conditions had not been changed. According to article 6, however, the assets created in order to increase the productive power of the plant to more than 396 million cubic metres of gas per annum are not to be included in those to be divided between the Company and the City on Jan. 1, 1906, but will belong entirely to the latter. By the next article, the Company are not to be allowed to raise fresh loan capital beyond 25,000,000 frs. without the previous consent of the Municipality; and any assets created by means of loans exceeding this amount will be the sole property of the City. In article 8 it is provided that the works of first establishment, forming part of the assets, to which the City is to have the exclusive right, as above specified, are to be carried out under the sanction of the municipal authorities. Articles 9 and 10 are important. In the former it is specified that, on Jan. 1, 1906, the City will become, by virtue of the arrangement for the division of the property, owner of the lands, buildings, and plant of the Company, on the following conditions, independently of those set forth in article 4: (1) The Municipality are to pay the Company the value of the latter's share of the property, in accordance with article 6 of the Treaty of Feb. 7, 1870, and with the terms of the present agreement. Until the complete liquidation of this debt, the Company are to continue working under the conditions in force at the end of the concession, but are to be responsible for the payment of the interest on, and the amortization of the capital; moreover, the deduction of the usual 11,200,000 frs. prior to the division of profits is no longer to take place. (2) The Company are to guarantee the maintenance and operation of their provident and other funds as they may exist in 1905; but any modifications of the existing condition of things which may be introduced are to be approved of by the Municipality. As from the 1st of January next, the two contracting parties agree to deduct, at the end of each year, 1 per cent. from the profits realized on the working of the undertaking, to be employed in the award of gratuities or bonuses to the workmen, in proportion to the amount of wages received during the year; the amounts are, however, to be paid, in the name of each workman, into the National Pension Fund for Old Age, with the view of augmenting the retiring pension granted by the Company. Passing the next article, which simply continues the portions of the Treaty of 1870 which are not specifically affected by the preceding articles, we come to article 11, which sets forth that, by special arrangement between the parties, the City reserves to itself the right of compelling the Company to continue the management of the undertaking for a period of 25 years from the termination of the concession; and the latter are to take all necessary steps to carry on the concern uninterruptedly until Dec. 31, 1930. The Municipality are to inform the Company, at the latest by Dec. 31, 1903, if they intend to exercise the right conferred by this article; and, as the result, the redemption of the bonds not liquidated on Dec. 31, 1905, will then fall upon the Company, who, however, will remain in possession of the property then in existence, including the distributing plant. In the event of the authorities deciding to put their powers in force, the Company undertake to continue the working of the concern in accordance with articles 1, 2, and 3 of this agreement, and in other respects conformably to the general provisions of the Treaty of 1870, with the following modifications: (1) As from Jan. 1, 1906, the deduction of the above-named sum of 11,200,000 frs. for the benefit of the shareholders before a division of profits takes place is to be discontinued. (2) From the same date, the consumers whose price is reduced under the terms of the present agreement are to share in the benefits resulting from the working of the undertaking, by the Company handing over to them at the close of each year, until the end of the concession, half of the net profits realized beyond a sum of 36,000,000 frs.; the other half to be added to the amount divisible equally between the City and the Company. The consumers' share is to be divided immediately after the accounts are made up, and allocated in proportion to the annual amount of their receipted gas bills; and in the case of regular consumers, the sum to which they may be entitled will be deducted from the first amount recoverable from them. All moneys due to consumers whose accounts are closed will stand to their credit in the Company's books, and be at their disposal for a period of five years. Notice is to be given every year, by three announcements in the *Official Journal*, at intervals of 15 days, commencing on April 1, of the distribution of the available profits on the preceding year's working. The consumers are not to have any cause of action against either the City or the Company in respect of the carrying out of the above-mentioned provisions. (3) The Company are to pay off, during the course of the 25 years by which the concession will be extended, the capital not liquidated on Dec. 31, 1905. (4) All money raised on loan for the development of the undertaking is to be repaid by Dec. 31, 1930; and no shares are to be issued without formal notice being given to the Municipal Council. (5) The reduction provided for in article 8 of the Treaty of 1870, on the tax of 2 c. per cubic metre of gas consumed in Paris, will cause an equivalent reduction in respect to the gas sold to the City and to private consumers. (6) Owing to the diminution in the price and the division of the profits stipulated for in the present scheme, certain articles of the existing Treaty will be annulled. Article 12 sets forth that the agreement of which the foregoing is an outline is not to come into operation until it has been adopted by the Municipal Council, and approved by the public authorities and the Company's shareholders; and the next, and final, article provides that all expenses are to be divided between the parties.

THE BIRMINGHAM CORPORATION GAS UNDERTAKING.

Visit of the City Council to the Saltley and Windsor Street Gas-Works.

Last Thursday, by invitation of the Chairman of the Gas Committee of the Birmingham Corporation (Mr. Alderman Pollack), the members of the City Council and a number of influential citizens inspected the gas-works of the Corporation at Saltley and Windsor Street. It is six years since these works were last officially visited; and, of course, many improvements have been effected therein, and the magnitude of the operations carried on very greatly increased. It was therefore thought by Alderman Pollack, whose enthusiastic work on the Gas Committee is a conspicuous feature of the Council's labours, that the time had arrived when his colleagues would like to see the extent of what is undoubtedly the largest undertaking at present under their control. The interest felt in the matter was manifested by the large number who accepted the invitation. The company, which included the Mayor (Mr. Alderman Lawley Parker), assembled at the Council House, where they were divided into two parties—one proceeding first to Windsor Street, under the guidance of Alderman Pollack; the other driving straight to Saltley, in charge of Mr. Edwin Smith, the Clerk to the Gas Committee. For the convenience of the visitors, plans and descriptions of both works were distributed to them; and from the latter we take the following particulars.

The Saltley Works.

At the Saltley Works, the visitors were received by the Engineer (Mr. Henry Hack, M.Inst.C.E.) and the Superintendent (Mr. J. W. Morrison), under whose guidance they inspected the whole plant and machinery; every detail in connection with the manufacture of gas being lucidly explained. These works occupy an area of 18½ acres. They are capable of carbonizing 1100 tons of coal per day, and producing about 10¼ million cubic feet of gas. Owing to the position of the original plant when taken over by the Corporation, and the shape of the land, the extensions which have recently been made had to be planned so as to provide two complete sections—No. 1 making about 5 million, and No. 2 about 5½ million cubic feet per day; the sections being so arranged that they can be worked either separately or in conjunction. Taking the sections in their order, in No. 1 there are two retort-houses, containing together 960 mouthpieces. The retorts are all Ω shape, 20 in. by 16 in. and 20 in. by 15 in., and 20 ft. long (throughs), set chiefly in beds of seven. Something like 38 per cent. of the retorts are heated on the regenerative system. There are two condensers—one of the vertical annular type; the other horizontal, formed of 9-inch pipes. The condensers can be worked separately or in conjunction, as may be required. The washer is one of Livesey's; and the scrubbers (four in number) are Mann and Walker's. They are each 15 feet in diameter and 75 feet high, and filled with coke. There are two exhausters—one being a Körting's steam-jet capable of passing 100,000 cubic feet of gas per hour, and the other a reciprocating exhauster, equal to dealing with 250,000 cubic feet per hour. It is worked by a 30-horse power compound steam-engine. The steam for this engine and the pumps is supplied by a 30 nominal horse power Cornish boiler, 25 feet long and 6 feet in diameter, fitted with Galloway tubes, and also by one of Babcock and Wilcox's tubular boilers of 96 indicated horse power. Both of these boilers have Meldrum's patent blowers, whereby breeze and breeze dust can be utilized as fuel in place of coke. The purifiers are seventeen in number; twelve of them being 30 feet square, and the remaining five 40 ft. by 35 ft. Eight of the former are charged with lime, and four with oxide of iron; while four of the latter contain lime and the other oxide. The covers are raised by hydraulic power applied to a ram 10 inches in diameter in the centre of each purifier. The filling and emptying process is accomplished by hydraulic cranes and adjustable wrought-iron shoots. The hydraulic power consists of a double-acting single-ram pump, driven by a Tangye 10-horse power (nominal) engine; also of a 12 nominal horse power Hathorn-Davey direct-acting pump, with four hydraulic rams and two steam cylinders. Adjoining are the accumulators, loaded to give a working pressure of 700 lbs. per square inch. Three station meters are in use, each of 100,000 cubic feet per hour capacity; the makers being Messrs. W. Parkinson and Co., Messrs. J. and J. Braddock, and the Lancashire Meter Company. The tar, liquor, and water pumps and engines are by Messrs. J. Evans and Sons, of Wolverhampton. We now pass to the second section of the works. This contains only one retort-house, with 902 mouthpieces; the retorts being of the same size and length as those in No. 1 section. On two benches they are in settings of eight; the remainder being sevens. All are heated on the regenerative system; and they are drawn, and the greater number of them charged, by West's stoking machinery, driven by compressed air. Additional machines are in course of construction for charging the remainder. The more recently added portion of the house is on the stage-floor plan, so that the coke falls on to a floor level with the canal. The gas is conveyed to the condensers by two 30-inch mains above ground, which in winter are of nearly sufficient power. These are supplemented by two condensers—one of the battery type, 106 feet long and 24 feet high; and the other one horizontal, the pipes being 9 inches in diameter. There are three washers and two scrubbers. One of the latter is of the Mann and Walker type, 20 feet in diameter and 75 feet high, as in No. 1 section; and the other one, by Messrs. C. and W. Walker, is 12 feet square and 26 feet high. Two reciprocating exhausters are employed, each capable of passing 250,000 cubic feet of gas per hour, driven by a 30 and a 40 nominal horse power high-pressure engine coupled direct to them. Steam is furnished by the Cornish boilers; two of them being of 30 nominal horse power, 27 feet long and 5 ft. 9 in. in diameter, and one of 35 nominal horse power, 30 feet long and 6 feet in diameter. There are eight lime purifiers, 24 feet square; and three for oxide, 40 feet by 30 feet. The covers of the former are raised by hydraulic power, with chains connected to two external vertical rams 9½ inches in diameter; those of the latter being lifted by central rams 10 inches in diameter, fixed inside the purifiers as in No. 1 section. The filling and emptying process is the same as in that case. The hydraulic power consists of one set of four pumps, 2 inches in diameter and 6-inch stroke, driven by a Tangye 6-horse power horizontal engine, and a 12-horse power

Hathorn-Davey direct-acting pump, with four hydraulic rams and two steam cylinders. The working pressure is about 700 lbs. per square inch. These and the two accumulators adjoining are also used for driving the capstans for hauling coal-trucks at the retort-house, and will also be employed for the large coke-staking crane in course of erection near the Saltley Viaduct, and in contemplation for other parts of the works. The two station meters are by Messrs. W. Parkinson and Co., and are each capable of passing 100,000 cubic feet of gas per hour. There are two 16-horse power vertical engines for driving the shafting of the tar, liquor, &c., pumps, which are of the ordinary piston type, varying from 4 to 6 inches in diameter, driven by one crank-shaft. There is, in addition, one 12 in. by 7 in. "Reliable" pump by Messrs. Evans and Sons, of Wolverhampton, for lifting the tar from the store to the sales tank on top of the exhauster-house. In this section there are three air compressors (two being each of 27, and one of 32 horse power), for compressing the air for driving the stoking machinery. The boilers are: One Babcock and Wilcox tubular, of 97 indicated horse power; one Lancashire, of 56; and one Cornish, of 35 nominal horse power. The gas produced in the two sections is stored in five holders, all telescopic. No. 1 is 148 feet in diameter, and has a capacity of 1,030,000 cubic feet; No. 2, 187 ft. 4 in. diameter and 2,130,000 cubic feet capacity; No. 3, 187 ft. 3 in. diameter and 2,150,000 cubic feet capacity; No. 4, 160 feet diameter and 1,200,000 cubic feet capacity; No. 5, 195 feet diameter and 2,100,000 cubic feet capacity. Nos. 2 and 3 were originally single-lift holders, each of about a million cubic feet capacity, and were telescoped in 1879. The governors comprise one 36-inch equilibrium, by Messrs. W. Parkinson and Co.; one of similar size and kind, by Messrs. W. and B. Cowan; and an ordinary 10-inch, by the first-named firm. These regulate the pressure on the 48-inch, 36-inch, and 10-inch mains by which the city is supplied. Carburetting apparatus is being installed by the Gas Lighting Improvement Company, for utilizing carburine as an enricher in place of cannel. It comprises a storeage tank of 25,000 gallons capacity, with pump and heater; and it is arranged for enriching a million cubic feet of ordinary coal gas per hour to the extent of one sperm candle. The whole of the water for the works, other than that consumed for drinking purposes, is now supplied from a well, the bore-hole of which is 300 feet deep. It yields 7500 gallons of water per hour, which is pumped into tanks over the exhauster-house; thence supplying the various portions of the works by gravitation. The well water is softened on the works by the Porter-Clark process. In addition to the 18½ acres of land covered by the works, the Gas Committee have about 17½ acres available for future extensions, excluding the Nechells Recreation Ground, or about 32 acres including this. The maximum number of men employed in the winter season now reaches 900. The estimated consumption of coal for the current year (ending in June next) is 206,000 tons. For conveying this into the works and removing the residuals, three locomotives are employed—one of 14½, and the other of 21 nominal horse power. Attached to the works are blacksmiths' and other workshops; and a fire brigade and an ambulance corps have been established. The following figures, showing the capacity of the Saltley works at the date of their transfer to the Corporation in 1875 and now, will be found interesting:—

	In 1875.	Present Time.
Number of retorts	584	931
Make of gas per day	5,250,000 cub. ft.	10,250,000 cub. ft.
Maximum output per day	5,559,000 "	11,374,000 "
Maximum weekly output	30,163,000 "	61,737,000 "
Yearly output	780,544,000 "	1,831,636,000 "
Gasholder capacity	4,480,000 "	8,640,000 "
Area of condensers, excluding mains	13,402 sq. ft.	46,743 sq. ft.
Washing and scrubbing capacity	12,228 cub. ft.	73,634 cub. ft.
Exhausters, hourly capacity including reserves	500,000 "	850,000 "
Purifying area	7,800 sq. ft.	28,000 sq. ft.
Measuring capacity of station meters, hourly	360,000 cub. ft.	500,000 cub. ft.
Motive power of all kinds, nominal horse power	114	414

The Windsor Street Works.

At these works, by the kindly consideration of Mr. Alderman Pollack, a very welcome luncheon was provided for his guests; and occasion was taken by the Mayor to thank him for giving his colleagues on the Council an opportunity of inspecting so important a branch of their operations. Under the guidance of the Chairman of the Gas Committee and the Engineer (Mr. Charles Hunt, M.Inst.C.E.), the tour of the works was made while the other section of the party proceeded to Saltley. Although some particulars in regard to this station were given in the JOURNAL last week, in connection with the visit of the Incorporated Institution of Gas Engineers, the following full description will probably not be the less interesting. At the date of the transfer of the gas undertakings to the Corporation in 1875, the area of these works was about nine acres, and their productive capacity 3⅜ million cubic feet per diem, with storeage for a little less than 3¼ million. There was no railway communication; the whole of the coal, excepting a small quantity brought by canal, having to be carted from Lawley Street and other coal depôts. The works have now a siding from the London and North-Western Railway. They occupy an area of about 26 acres; and when the extensions in progress are completed, they will have a productive capacity of about 10½ million cubic feet a day. This is capable of being largely increased by the complete utilization of the site. There is also storeage for 17½ million cubic feet. On the old side of the works, two out of the four retort-houses are still retained for use during the winter months. These contain 616 21 in. by 15 in. oval through retorts, 18 feet in length, set in beds of seven, and fired in the ordinary way. The new retort-house is a building 487 ft. 6 in. in length by 210 feet total width, occupying an area of about 2¼ acres. It is approached by three lines of overhead rails, enabling coal to be dropped from the waggons on to the charging-stage, which is 10 feet above the level of the yard. An arm of the Birmingham Canal extends within the retort-house to nearly its full length, and intermediate between the benches. Parallel with it for about one-half its length, is a railway dock. The retort-house already contains 1194 mouthpieces; and there are arches for 252 additional ones. The retorts are throughs—22 in. by 16 in. oval, and 21 in. by 15 in. ⌂ section, set in beds of eight and nine. Both of the two benches are divided into three sections, each comprising 14 beds of retorts. In the oldest or first half of the house, the retorts are 20 feet in length; but those set more recently are 22 ft. 3 in., and the inclined retorts are 22 ft. 7 in. long, exclusive of the mouthpieces. The method of heating employed is regenerative; the system being Hunt's modification of Klönne's. In the first half of the house, Ross's machines, made by Tangyes Limited, are used for drawing the retorts. These are actuated by steam, from a portable boiler attached to each machine. In the second half, Foulis's machines are used. They are worked by hydraulic power distributed at 350 lbs. pressure from a station situated at the end of the retort-house. The hydraulic machines and appliances, pumps, accumulator, and distributing-pipes, were supplied by Sir W. Arrol and Co. The steam is generated by two 101-horse power nominal Babcock and Wilcox boilers. The Coze system of inclined retorts is applied in No. 2 section of the second half of the house to arches which were constructed for horizontal retorts; structural alterations having been avoided as far as practicable. The arches, 14 in number, are 8 ft. 8 in. wide, and 20 feet in length. Each arch contains nine 21-inch by 15-inch ⌂ retorts, set at an angle of about 29°. Two sets of battery condensers, each 80 feet long by 30 feet high, forming a part of the old works, are used in connection with the old retort-houses. From the new retort-house, the gas is conveyed by two 30-inch steel mains, suspended from the railway viaduct to three sets of atmospheric condensers, consisting of a series of cast-iron flanged pipes, 9 inches internal diameter. Above the condensers are placed the water and tar tanks. Provision has been made for the erection of two additional sets of condensers when required. At the outlet of the new condensers are placed three Livesey washers. The exhausters are of the rotary type. Two have a capacity of 150,000 cubic feet of gas per hour each, made by Messrs. G. Waller and Co., and are driven direct by horizontal condensing engines, having cylinders 16 inches in diameter and 20-inch stroke. The third in the same row, supplied by Messrs. B. Donkin and Co., is capable of passing 200,000 cubic feet per hour, and is driven direct by a non-condensing Roby engine, having a 14-inch cylinder with 20-inch stroke. On the opposite side of the house are a pair of 150,000 cubic feet per hour Beale's exhausters, coupled to a tandem engine, having a high-pressure cylinder 16 inches in diameter, and a low-pressure one 25 inches in diameter, both with 18-inch stroke. These have recently been supplied by Messrs. W. H. Allen and Co. There are three 26 ft. by 6 ft. 6 in. Lancashire boilers—one fitted with Perret's furnace and forced draught for burning breeze dust; two 141 nominal horse power Babcock and Wilcox boilers, with a Bumstead and Chandler's slow-speed fan for forced draught. With regard to the scrubbing plant, on the old side of the works there are one Mann and Walker tower scrubber, 20 feet in diameter by 60 feet high, and one liquor scrubber, 20 feet in diameter by 40 feet high. On the new side, there are two of Kirkham, Hulett, and Chandler's washer-scrubbers, each of the nominal capacity of 5 million cubic feet per diem. On the old side, there are one set of four purifiers, 24 feet square, for lime, with small travelling "Goliath" for lifting the covers; and two 28 ft. by 32 ft. purifiers, as catches, with hydraulic travelling lift on overhead rails for lifting the covers. The connections are 24 inch, with slide-valves for controlling the purifiers. On the new side, there are one set of four 66 ft. by 32 ft. lime purifiers, with 24-inch connections and dry centre-valve, and one with 24-inch connections and Cutler's hydraulic valves. For raising the covers (weighing about 25 tons each) of both sets, there are two travelling lifts on overhead rails, with worm and screw gearing, worked by hand. There are six 40 ft. by 32 ft. purifiers, arranged as catches, with 24-inch connections and Cutler's hydraulic and slide-valves. For raising the covers, there are two hydraulic travelling lifts on overhead rails worked at 700 lbs. pressure from the accumulator near the gas-engine house. The lime for the purifiers on the new side is conveyed by a waggon hoist to an overhead floor, where it is slaked and prepared for use. On this floor, above the catch purifiers, are four hydraulic cranes for lifting the oxide out of the purifiers. With regard to the station meters, on the old side there is one capable of passing 100,000 cubic feet of gas per hour, by Messrs. W. and B. Cowan; and on the new side there are three for 150,000 cubic feet per hour—one by Messrs. J. and J. Braddock, and two by Messrs. W. Parkinson and Co. There are two 12-horse power "Otto" gas-engines, by Crossley. These drive the shafting for all tools, &c., in the machine fitting and carpenters' shops and the smithy; and also two hydraulic pumps, working up to a pressure of 700 lbs. per square inch, with accumulator having a 10-inch ram. There is also one of Tangyes' 1 cwt. size gas-hammers; for smithy purposes, capable of striking a maximum blow equal to that which would be given by a weight of 4½ cwt. falling through a height of 1 foot. It gives 120 blows per minute. There are three vertical-ram steam-pumps, by Tangyes Limited, for water and ammoniacal liquor; and one horizontal "Special" steam-pump, by the same firm, for tar. The underground connecting mains on the old side are 24 inches in diameter. On the new side, from the condensers to the meters, they are 36 inches in duplicate. At the outlet of the meters, there is a 48-inch main to the gasholders. Coal is stored under the railway viaducts, which are 20 feet above the ground line, and is picked up and loaded into waggons by elevators, three in number, and 41 feet high, placed in suitable positions. The experimental works and laboratory comprise three cast-iron retorts in separate settings, each to carbonize ½ cwt. charges; condensing and purifying plant; three gasholders, of 20, 350, and 970 cubic feet capacity; and photometrical appliances. For the storeage of tar and liquor, there is on the old side one underground tank, 30 feet in diameter and 14 feet deep; and on the new side one (formerly a gasholder tank) 82 feet by 20 feet. The gasholders are:

	Diameter of Outer Lift. Feet.	Capacity. Cubic Feet.
Two, with two lifts each	95	273,000
Four " "	100	356,000
One " "	140	728,000
One " "	197½	2,100,000
Two, with three lifts each	236	6,250,000

The extreme height of the latter, when filled, is about 165 feet. The total storeage is 17,298,000 cubic feet. The governors are 18, 24, 30, and 36 inches in diameter. There are meter-repairing shops, through which about 8500 consumers' meters pass yearly.

It may be added that, including the smaller works at Adderley Street and Swan Village, the Birmingham Corporation Gas Department represents a capital expenditure of £2,197,446; and that last year 452,832 tons of coal were carbonized, resulting in an income of £453,086 from the sale of gas, and of upwards of £135,000 from the disposal of residual products.

IMPORTANT SALES OF STOCK AND SHARES.

At Bristol last Wednesday, Messrs. Nichols, Smith, and Alder sold locally £31,300 of new debenture stock in the *Bristol Gas Company*. A large number of purchasers assembled; and the competition was very keen. The stock was put up in £100 lots; and was disposed of at the following prices: 27 lots at £104 10s.; 44, at £104 15s.; 76, at £105; 42, at £105 5s.; 12, at £105 10s.; 22, at £105 15s.; 10, at £105 17s. 6d.; 5, at £106; 5, at £106 2s. 6d.; 10, at £106 5s.; 14 at £106 7s. 6d.; 27, at £106 10s.; 18, at £106 12s. 6d.; and 1, at £106 15s. The total amount realized was £33,070 17s., or an average per share of £105 8s. 5d., being 34s. a share more than the average at the last sale.——Messrs. Alexander, Daniel, Selfe, and Co. sold by auction at Bristol last Thursday week, £10,000 of 7 per cent. maximum ordinary stock in the *Bristol Water-Works Company*. Biddings were made very briskly; but the prices realized did not come up to the average (£140 16s. 3d.) when similar stock was sold last year. The top figure obtained was £139, and the lowest, £136; the total produced by the sale being £13,636 10s.——New consolidated stock to the amount of £17,000 in the *Newcastle and Gateshead Gas Company* was sold by auction at the offices last Wednesday by Mr. Robert Mack. There was a numerous attendance of investors; and the bidding was very spirited. The prices obtained were as follows: £200 sold at £190 5s. per cent.; £1750, at £190 2s. 6d. per cent.; £4350, at £190 per cent.; £1000, at £189 15s. per cent.; £500, at £189 12s. 6d. per cent.; £500, at £189 10s. per cent.; £1400, at £189 7s. 6d. per cent.; £1000, at £189 5s. per cent.; £2000, at £189 per cent.; £2800, at £188 15s. per cent.; £500, at £188 10s. per cent.; £1000, at £188 5s. per cent. These figures give a total of £32,199 13s. 3d. for the £17,000 stock, or an average of £189 8s. for each £100; being £1 12s. less than the market value.——At Swansea last Friday week, Messrs. J. M. Leeder and Son offered by auction 500 new ordinary 7 per cent. shares (1888) of £25 each in the *Swansea Gas Company*, being part of the additional capital authorized by their Order of 1888. There was a good attendance, and the bidding was spirited. The whole of the shares were disposed of at an average price of £35 6s.; the highest lots fetching £35 7s. 6d., and the lowest £35 5s.——Mr. J. W. Crosby offered for sale, at West Hartlepool last Thursday, 300 shares of £10 each in the *Hartlepool Gas and Water Company*, the maximum dividend on which is 7 per cent. per annum. The prices varied between £16 7s. 6d. and £18 17s. 6d. each; and the total proceeds of the sale were a little above £5000.

Johannesburg Water Company.—At the annual meeting of this Company recently held at Johannesburg, the Chairman (Mr. J. Tudhope) commented on the rapid advance which the Company had made during the past financial year, and referred to the completion of the new reservoirs, which would, he said, ensure an abundant supply of water for the next dry season, and remove any fear that might exist as to the possibility of troubles from prolonged droughts.

Mr. David Terrace on Gas and its Uses.—On Monday and Tuesday last week, Mr. Terrace, the Gas Engineer of the Middlesbrough Corporation, made a large number of the inhabitants of that borough acquainted—possibly for the first time—with the best means of using gas for domestic purposes. In the crypt of the new Town Hall, he delivered, on the above-named days, a most interesting lecture, with lime-light illustrations, having for its object the dissemination of information as to how gas consumers might obtain more light at less cost, and perform their culinary operations with greater facility and cleanliness. In conjunction with the lectures, there was an exhibition of gas appliances on Tuesday.

A Wasteful Water Consumer Punished.—At the West London Police Court on Monday last week, a summons was heard against the Secretary of the West Middlesex Water Company, at the instance of Mr. H. B. Robinson, owner of No. 172, Warwick Road, Kensington, for refusing to give a supply of water to his premises. Mr. Ingle appeared to support the summons; and Mr. Bodkin represented the Company. Ellen North, the wife of a cab proprietor, said they were the occupiers of the premises in question. The water was cut off that day fortnight; and there had not been any supply since to the house or stable. In cross-examination, she said they had lived at the place four years, paying their rent to the agents of the landlord. The water-rate was included in the rent. The premises consisted of the stable and the living rooms upstairs. In the yard there was a tank used for washing the cabs. It was let into the ground, and was level with the surface of the yard. There had been no regular complaint of the waste of water; but the turncock had complained as he was passing. She told her husband, who had the cistern repaired, and the waste was stopped. All the papers served on them were sent to the agents; but no one came to look at the cistern. Mr. Bodkin pointed out that the Company had power to make certain regulations, and there was one prohibiting the use of cisterns embedded in the ground, unless permitted by the Company in writing. However, the water was cut off to stop the waste. Witnesses were called to prove that a notice was served stating that the supply would be disconnected unless the waste was prevented. All the witnesses stated that the waste was continued, even on the day when the supply was cut off. Mr. Plowden thought the Company had given the consumer every opportunity to remedy the mischief. He dismissed the summons, and ordered complainant to pay £2 2s. costs.

BELFAST CORPORATION GAS SUPPLY.

Annual Accounts.

The abstract of the accounts of the Belfast Corporation Gas Department for the year ending June 30 last has been published. It shows, under the head of receipts, that on June 30, 1891, there was a balance due by the Treasurer on the sinking fund account of £4175; and interest allowed on sinking fund account, £24. The gas-rental for the past year amounted to £126,615, of which £110,927 was derived from private consumers; £131, from private lamps under agreement; £15,151, from public lamps; and £405, from the Harbour Commissioners' lamps. Residual products produced £59,860, divided as follows: Coke, breeze, and cartage, £44,805; tar, £8120; ammoniacal liquor, £6931; and carbon, £4. Sundry receipts amounted to £4381, of which the two principal items were for laying mains and service-pipes, £1447, and the hire and sale of gas-stoves, £2336. An item "Corporation 3½ per cent. stock" stands at £56,200; and "balance due to Treasurer at foot of current account," £6125, makes the total on the receipts side of the statement £257,382. On the expenditure side, the balance due to the Treasurer on current account at June 30, 1891, is entered at £13,593. The manufacture of gas cost £111,442, which sum was made up of coal (including delivery) £86,503; purifying materials, £2524; wages of workmen at purifiers, £1439; carbonization of coal (stokers' wages, &c.), £16,373; workmen's wages at coke, £3354; cartage of coke, &c., £1249. The repair and maintenance of works and plant absorbed £9109; repairs, maintenance, and renewal of gas-mains and service-pipes, £2363; and repairing and refixing meters, £3324. In lighting and repairing public lamps £4449 was spent; and the outlay on gas stoves and apparatus was £1879. Rents, rates, and taxes caused an expenditure of £4408; and miscellaneous disbursements amounted to £2242. Deposits for gas and service-pipes amounting to £57 were repaid. The expenditure on new works stands at £19,779; and a sum of £6493 was paid away in salaries. The other items are: Dividend on 3½ per cent. stock, £5303; interest to mortgagees, £7983; loans paid off (partly from sinking fund account), £61,279; balance due by Treasurer at foot of sinking fund accounts, £3676.

EXTENSIONS AT THE ROCHDALE GAS-WORKS.

[Objections by Property-Owners.

As already briefly mentioned in the JOURNAL, Mr. ARNOLD TAYLOR held an inquiry, on the 7th inst., on behalf of the Local Government Board, into an application by the Rochdale Corporation to borrow, among other sums, £65,000 for the extension of the gas-works.

The TOWN CLERK (Mr. Z. Mellor) said the Corporation obtained power to raise £517,216; and the amount still to borrow was £102,196. According to the estimate of their Gas Engineer and Manager (Mr. T. Banbury Ball), it would cost the £65,000 they wanted to borrow to carry out the alterations proposed at the gas-works. At present there were 417 retorts, calculated to yield 2¼ million cubic feet of gas in 24 hours. It was proposed to erect a new retort-house, containing 266 retorts, capable of yielding about 1,600,000 cubic feet of gas in 24 hours. The estimated cost of this was £25,500. It was also proposed to build a new gasholder and tank; the latter to be 153 feet in diameter and 30 feet deep, and the holder to be 150 feet in diameter, and 120 feet high.

Mr. BALL produced plans, and explained in detail what it was proposed to do. He said that at present storeage was exceedingly limited. During the last 20 years, nothing had been done in the way of providing additional gasholders. An entirely new trunk main had recently been laid along the Esplanade, some 500 yards in length, and others had been enlarged. The cost was £4000; but they asked for only £2000, as the rest would come out of revenue.

Mr. ELLIOTT said the debt was £165,000, but upwards of £200,000 had been spent on the works.

The TOWN CLERK here raised a question as to the number of years in which the loan was to be repaid. Parliament stated 75 years; and he did not like this being cut down by one-half by the Local Government Board.

The INSPECTOR referred to the probable influence of electric lighting on the consumption of gas.

Mr. BALL said supposing every mill in Rochdale—and they might roughly estimate them at 300—were to use the electric light, the Corporation had about 20,000 customers, 16,000 of whom burnt gas supplied through the smallest size of meter made; so they had always 16,000 customers.

The MAYOR (Mr. Alderman Duckworth) stated, and he was supported by Mr. Ball, that electric lighting was beneficial to them to a certain extent. A great change was taking place; and as people were becoming accustomed to the new light, they were using gas more largely for other purposes, such as cooking, gas-engines, &c.

The INSPECTOR said he would report the facts to the Local Government Board. Mr. Mellor seemed strongly in favour of a longer time for repayment. Whether or not he would get it, he (Mr. Taylor) did not know; but he would report what had been said on the matter.

The next business was about to be taken, when

The Rev. J. GIBSON interposed, and said a petition against the present proposal had been sent in by owners of the property with which he was connected, calling attention to the fact that it was *ultra vires* to do the work without the consent of the owners, occupiers, and ratepayers residing within a certain distance of the works.

The INSPECTOR said that, after due consideration of the memorial, a Provisional Order was granted. On the suggestion of Mr. Gibson, he read a particular clause in the Act of Parliament, stating that it was only with the consent of the owners and occupiers of property within 300 yards of the works that the latter could be erected.

Mr. GIBSON: It comes to this—that there is an Act of Parliament protecting our rights; that we claim its protection; and that we are then told what has been done, in some way we know nothing about, by the Local Government Board overriding our rights.

Mr. ELLIOTT pointed out that the Provisional Order had been passed by Parliament.

Mr. GIBSON said he was not aware of that; and he proceeded to contend that the Local Government Board's reply ought to have been sent to the gentleman who forwarded the petition. He asked if the inquiry could be adjourned until the property-owners had had time to meet and consider the matter.

The INSPECTOR: Certainly not.

Mr. GIBSON said they seemed to have lost their rights simply by accident. The Act had been passed through Parliament without their knowledge at all. Could they oppose on the ground of depreciation of property?

The INSPECTOR replied in the negative. He said the Act of Parliament had authorized the carrying out of this work.

This closed the inquiry so far as it related to the gas-works.

STAFFORD CORPORATION GAS SUPPLY.

The Engineer's Salary—Statistics as to the Progress of the Undertaking—The Wages of the Employees.

At the last Monthly Meeting of the Stafford Town Council—the MAYOR (Mr. Alderman W. Lloyd) presiding—a proposal to increase the salary of the Engineer (Mr. J. Ferguson Bell, Assoc.M.Inst.C.E.) by £100 per annum was under consideration.

Alderman W. H. PEACH, in moving the necessary resolution, gave some interesting particulars concerning the progress of the undertaking. Referring in the first place to the visit of the members of the Council to the gas-works to inspect the extensions and alterations lately carried out there (as recorded in our last issue), he said that these had involved an enormous amount of thought, labour, and skill, and had been executed without a hitch of any kind and in the most successful manner possible. In 1883, when Mr. Bell's management commenced, the consumption of gas was 74,500,000 cubic feet; while this year it would amount to 120,000,000 feet, or an increase of 60 per cent. This increase, it was evident, was not caused by any increase of population; but the result was due entirely to the Manager's tact and ability in opening up new business and popularizing the use of gas as a heating, cooking, and motive power. To him was due the introduction of the system of fortnightly consumers; and there were now nearly 1000 working men who used gas who never did so before. As regarded the price charged for gas, in 1883 it was 3s. 4d. per 1000 cubic feet net; to-day it was 2s. 3d. to 2s. 9d. without meter-rents, which were charged in 1883. This meant that consumers paid £4000 less for gas than they would have done had it been the same price as in 1883. In the four years prior to Mr. Bell's appointment, the gross profits were £22,929; while in the past four years they had been £27,468, or an increase of £4539—more than £1100 a year—and while this year the consumers obtained gas at £4000 less, the ratepayers gained £2000 directly in reduction of the rates. Next year it would be the same; and, indirectly, nearly £3000—that was to say, in the reserve, depreciation, and sinking funds. With all these benefits to the ratepayers and consumers alike, the capital was no more than when Mr. Bell came, although £20,000 was now being spent in improving the place, and bringing things thoroughly up to date. The secret of all this lay in their Engineer's attention to the retort-house as well as to the residual products. Some six years ago he invented and patented a regenerator gas furnace, by which not only was more gas produced per ton of coal carbonized, but a larger amount of coke in the shape of fuel was saved. The furnaces were put in No. 1 retort-house, with the following result: In 1881 the coke sold realized £669; in 1882, £737; in 1883, £805—a total of £2112. In 1890 the coke sold produced £1910; in 1891, £2438; in 1892, £2345—a total of £6694. That was an increase over the first three years of £4582, or £1500 per annum. In 1881-3 the coal carbonized amounted to 22,119 tons; in 1890-2, it was £33,411 tons, or 50 per cent. more. If an additional 50 per cent. had been carbonized on the old plan, the result would have been £1056 more, or £3168, which would have still left a difference of £3526, or £1175 per annum in favour of Mr. Bell's furnaces. The difference did not arise from the variation in the price of coke. In 1883, nearly 50 per cent. of the coke made was used as fuel. From this year's accounts, they would find that only 29 per cent. was so consumed, including fuel used for boilers, sulphate making, and the works generally. The total make of coke last year was 7871 tons; so that the difference between the two systems was more than 1500 tons a year in their favour. The value of this could easily be reckoned. Besides, the life of a retort was nearly doubled. An ordinary through retort lasted three years; but the bench in No. 1 retort-house had been in use nearly six years, and seemed almost as good as when it was put in. Mr. Bell had applied his system to the new retort-house. In No. 1 house there were two furnaces to 14 retorts; while in the new house there was only one to 18, which represented a still greater saving. Their Engineer calculated that, by dropping the old bench of retorts in No. 2 house, and using his furnaces all through, the coke used as fuel would not exceed 15 per cent. on the total make, which would yield an annual profit, compared with the present mixed system, of not only as much as the proposed advance, but much more than the whole of his increased salary. Having referred to Mr. Bell's work in drawing up a scheme for the electric lighting of the town, he said that the gas undertaking had been successful in a remarkable degree; and as business men, who were responsible to the ratepayers for such a valuable property, they must see it was maintained. To do this, they must retain Mr. Bell and pay him a fair remuneration for his services. The Committee had passed the resolution unanimously; and he trusted there would be a unanimous vote of the Council.

Mr. SILVESTER seconded the resolution; remarking that he thought Mr. Bell was fully entitled to the money they proposed to give him.

Mr. GEDDES denied that the resolution of the Committee was unanimous. He thought if they halved the increase, and gave £50 more, it would be satisfactory both to Mr. Bell and to the ratepayers; and he moved accordingly.

Mr. GIBSON seconded the amendment.

Alderman GOODALL said he was of opinion the recommendation was unanimous. Some of them did think it was a large increase at first; but afterwards the recommendation appeared to be unanimous.

Mr. HEATH, as representing the working classes, said he knew the proposed increase had given great dissatisfaction. There was a prevalent idea that, if the gas-works were so successful, the labourers employed there should have better remuneration for their labour than they were receiving. No one could say a word against their Manager, and they respected him and his ability. But if they granted a rise of £50, and took into consideration the increase of the labourers' wages, it would give a great deal more satisfaction to the public.

The MAYOR thought that subject would come under the notice of the Committee.

The recommendation was carried—8 voting for the amendment and 14 for the resolution.

Alderman W. PEACH afterwards referred to a letter which had been sent to the Council regarding the wages of the stokers and labourers at the gas-works; and he suggested that the matter should be referred to the Gas Committee.

Mr. GEDDES expressed the opinion that, as the works were of a prosperous character, the labourers and stokers should have an equal share of the prosperity.

Alderman W. H. PEACH remarked that he did not know why the Riverside and Dock Labourers' Union should interfere between the Corporation and their employees, who were paid more per ton of coal carbonized than at 25 other gas-works where inquiries were made.

The letter was then referred to the Committee.

PROPOSED EXTENSIONS AT THE MIDDLETON GAS-WORKS.

An inquiry was recently held by Mr. Arnold Taylor, of the Local Government Board, into an application by the Middleton Corporation for power to borrow £11,921 for the extension of the gas-works. The Town Clerk (Mr. F. Entwistle) stated that, under the Middleton and Tonge Improvement Act, 1861, the Improvement Commissioners were allowed to purchase the gas-works, in consideration of certain annuities; while, under the same Act, they were authorized to borrow £36,000 to pay for the works. In 1881 the Local Government Board granted a Provisional Order raising their borrowing powers to £56,000; but the £20,000 increase could not be borrowed without the sanction of the Board. The same year they obtained permission to borrow £8079 of the £20,000, which left £11,921 which the Corporation were now seeking. Mr. G. Booth, Chairman of the Gas Committee, said the consumption of gas had increased during the past ten years from 50 to 80 million cubic feet. Some few months ago, they only had 60 gas cooking-stoves; but now they had about 220. The number of gas-engines was also increasing. The price charged was from 3s. to 3s. 4d. per 1000 cubic feet for lighting, but 6d. less for other purposes. The Gas Manager (Mr. Tim. Duxbury) then gave a detailed account of the proposed extensions. He said the present purifiers were erected in 1872, during which year the quantity of gas required to be purified was 44 millions, against 80 millions at the present time, or an increase of 82½ per cent. The quantity of gas purified in 24 hours was 350,000 cubic feet, with a maximum on Dec. 24, 1891, of 552,000 cubic feet. There had been no addition to the purifiers since 1872; and they now proposed to erect plant to cost £3036, to include new purifiers, new purifying-house, extension of mains, and a new gasholder, station meter, and retorts. The Inspector said he thought the money would be allowed, to be paid back in 30 years. He advised the Corporation, when they again thought of borrowing, to ask for enough, and not stint themselves. In answer to the Inspector, Mr. Duxbury stated that the Corporation were at present testing the various prepayment gas-meters; and they would adopt the best for use in the borough. They had about 1000 or 1500 persons who did not use gas at present; and, without doubt, there would be a large demand for these meters. The inquiry then closed.

Proposed Purchase of the Nuneaton Gas-Works.—The Nuneaton Local Board last Wednesday resolved to engage a gas engineer to report upon, and advise as to the purchasing of, the local gas-works.

Gas Explosion at Tynemouth.—Considerable damage was caused by an explosion of gas at the Tynemouth Railway Station last Friday week. An after examination of the fittings revealed the fact that there was a leakage from a pipe conveying gas to one of the waiting-rooms; and the gas must have accumulated between the ceiling and the gas-jets. The force of the explosion may be imagined, when it is stated that the roof of the room appears to have been lifted bodily from its position, about twenty windows were damaged, and a portion of the glass roof over the outer platform. A porter was also injured, but not seriously.

Londonderry and the Electric Light.—The Londonderry Corporation last Tuesday adopted a resolution deciding to light the entire city by electric arc lamps of "2000-candle power" at a cost not exceeding £12,500. Mr. Magee, the Chairman of the Lighting Committee, said the system would be similar to that adopted in Dublin, except that each street would be lighted by two distinct engines, so that failure of light was practically impossible. The Gas Company charged the Corporation £2000 yearly for the present lamps; and this sum would not only pay interest on a loan, but provide for a sinking fund, and leave a profit of £200.

The Development of the Rawmarsh Gas-Works.—Major-General Crozier, R.E., one of the Inspectors of the Local Government Board, held an inquiry at Rawmarsh last Wednesday, relative to a proposal by the Local Board to borrow £7000 for gas-works purposes. During the two years that the Local Authority have manufactured gas there have been considerable developments. The quantity of gas consumed in 1889 was only 15,000,000 cubic feet; whereas at the present time it is 27,500,000 feet, and is daily increasing. In 1889 there were 219 public lamps; now there are 264, and additional ones are required. The Rawmarsh district is growing rapidly; and the number of private consumers is 676.

THE METROPOLITAN WATER SUPPLY COMMISSION.

Eighteenth Day—Thursday, Oct. 6.

(*Lord* BALFOUR OF BURLEIGH, *Chairman*; *Sir* G. B. BRUCE, *Sir* A. GEIKIE, *Professor* DEWAR, *Dr.* W. OGLE, *Mr.* G. H. HILL, *and Mr.* J. MANSERGH, *Commissioners.*)

At the opening of the proceedings this morning,

The CHAIRMAN made an announcement that within the past week or two a document, represented to be notes of an interview which took place between the Commission and Sir George Buchanan, had, in an incomplete, and he might say incorrect form, been made public without the consent of the Commissioners. It was simply a report of a meeting which took place between the Commissioners and Sir George, as the Commissioners thought his experience might be of use to them with respect to the course of the investigation which it might be their duty to undertake. The account of the interview would probably have seen the light at the time of their report; and the Commission did not contemplate making it public before. But as it had got out, as he had said, in an incomplete form, without their consent, they had discussed the matter, and thought that, as some incorrect inferences had been drawn from what had appeared, the best course they could pursue would be to make available, to anyone who desired to see it, an authentic account of what took place. They had obtained Sir George Buchanan's consent; and as soon as the necessary prints could be procured, a copy would be supplied to anybody who applied for one.*

Mr. *Baldwin Latham*, M.Inst.C.E., was the first witness.

The CHAIRMAN, referring to the paper which witness had submitted, said the Commission considered a considerable part of it did not come within the scope of the inquiry. He understood witness's opinion to be that in the Rivers Thames and Lea, and also in the chalk formation round London, there was an abundance of good and wholesome water that would practically serve London and its neighbourhood for a century to come.

Witness said that was so; and he added, with regard to the tables of rainfall and population he had prepared, that there was no practical difference between Mr. Symons and himself.

The CHAIRMAN: In your statement you observe: "It will be noted that, between the last two census periods, although in London and the whole country there is a diminution in the rate of increase of the population, in London it has been from 17·25 to 10·36 per cent., or a difference of 6·89 per cent.; while in England and Wales the diminution has been from 14·36 to 11·65 per cent., or only 2·71 per cent.—showing that London is not increasing in anything like so fast a ratio as the whole country." At the end of the same paragraph, after remarking that you take the consumption for the next forty years, you say: "The population at the present time being 5,739,538, and the increase 3,003,988 in the last 40 years, the same figures added to the present population will show that the population to be provided for in 40 years' time will be 8,743,526."

Witness said this was so. He explained that it could not refer to registration London, but to the special districts mentioned in his paper, including registration London; then north of the Thames, the registration district of Sunbury and Isleworth, Twickenham, Brentford, Chiswick, Acton, Willesden, Harrow, Edgware, South Edgware and Barnet, Finchley, Hendon, Hornsey, Tottenham, Edmonton, Hayes, Waltham Abbey, Cheshunt, Hoddesdon, Ware, Stratford, Plaistow, Canning Town, Forest Gate, East Ham, Leyton, Walthamstow, Chigwell, Epping, Harlow, Romford, Ilford, Barking Town, and Enfield; then on the south of London, Croydon, Mitcham, Wimbledon, Carshalton, Epsom, Leatherhead, Reigate, Dorking, Capel, Horley, Kingston, Esher, Hampton, Richmond, Mortlake, Bromley, Chislehurst, Bexley, Dartford, and Farningham. Only a portion of the Croydon registration district was supplied from the Croydon Water-Works; the rest being served by the Lambeth Water-Works Company. Mitcham was supplied partly from local sources and partly by the Lambeth Company; Wimbledon, by the Lambeth and Southwark and Vauxhall Companies, as well as from private artesian wells; Carshalton, from the Sutton works, and also from local wells; Epsom, partly by the Leatherhead Water Company, and partly by the works of the Epsom Local Board. Reigate was now supplied by the Surrey Company, and had its own works which had been acquired by that Company; but Dorking was served from its own works. Capel and Horley had no water-works; Kingston was supplied by the Lambeth Company; Esher, by the Lambeth Company; Hampton, partly by the Lambeth Company and partly from the Hampton works which were public property; Richmond, partly by meter from one of the London Water Companies, and from its own local sources; Mortlake, by one of the London Water Companies; and Bromley, Chislehurst, Bexley, and Dartford, by the Kent Company. He estimated for London 31¼ gallons per head per day; but he did not suppose more than 15 gallons could possibly be used for domestic purposes, if proper means for the prevention of waste were adopted. In his own house, in which 15 or 16 people resided, the water being also used in the summer for watering the gardens, and the use of baths being common, the consumption on an average of three years did not amount to 22 gallons per head per day. In Croydon, with waste-water prevention cisterns to water-closets, the consumption went down to 8 gallons per head per day; while in other districts in the same town where no such fittings existed, 100 gallons were used—the property in both cases being of a similar class. In Atherstone also, where there was 300 feet pressure and a constant service, the supply was 6 gallons per head per day. Reckoning, however, 31¼ gallons per head for some 8,743,000 people, this would represent 273,233,000 gallons, or, as he called it, 275,000,000 gallons. Being requested to go over the sources from which he thought it would be safe for the Commission to calculate that this quantity of water could be obtained, witness stated that he was in possession of all the Lea gaugings from an early period up to the year 1884. Having acted for the Millowners' Association he knew the gaugings of all the streams round London, and their probable yield; and he had examined and valued every mill and the water power on these streams. His information showed that 1864 was the lowest water period recorded with regard to the Lea, and not 1874 as had been stated by other witnesses; and it was a curious coincidence that every tenth year from 1834 to 1884 was, without exception, a low-water year. The Lea, with adequate storeage accommodation, would supply 70,000,000 gallons of water per day from surface sources, independently of underground water, from which he calculated an additional 30,000,000 gallons. To deal with the 70,000,000 gallons properly, they would require storeage accommodation to the extent of 877,000,000 cubic feet. These quantities he believed to be an under-estimate, especially with regard to the underground water, as 30,000,000 gallons were now being taken from the chalk. From the Epsom district, of which the principal stream was the Hogg's Mill River, he calculated that 3,000,000 gallons a day could be obtained, only about half a million of which was now being utilized. From the Wandle and the Ravensbourne, he estimated that 10,000,000 gallons a day could be drawn, of which only 5,000,000 or 6,000,000 gallons were now being used; and this could be done without having any effect upon the rivers. The Wandle alone could supply 25,000,000 gallons of water daily if required, by giving compensation to the mills. From the area of the Mole, which was tapped by the water-works of Dorking, Reigate, and Leatherhead, another 10,000,000 gallons a day could be obtained; the average flow of the river being 6900 cubic feet a minute, a very large part of which went off in time of floods. The area east and south-east of London which supplied the Kent district he put down at 30,000,000 gallons, of which something like one-half was now taken for local requirements. They now came to Essex; and he gave there a site, at Grays, with 3,000,000 gallons of entirely underground water per day, the taking of which would not interfere with any Authority. Then there were the existing works in the Colne Valley. Their yield he had taken as 10,000,000 gallons daily, which he did not think there was any difficulty whatever in acquiring under existing powers. Then he proposed to prevent the water now going down the Duke of Northumberland's river from continuing to do so. That river and the Cardinal's river both tapped the Colne above the intakes of the Water Companies; and he had placed this at the small quantity of 15,000,000 gallons per diem. In addition to this, he had put the present powers of the Water Companies at 130,000,000 gallons daily; making a total with those figures of 311,000,000 gallons. He was of opinion that, if compensation were given to the mills, there was no doubt that the streams immediately around London would themselves supply 250,000,000 gallons of water per day. The Darenth, the Cray, and the various streams in the neighbourhood of London would furnish this large supply of water; the Darenth and the Cray being copious streams. Asked whether, having regard to the valuable property in water power of the various streams around London, the extra water could be taken without interfering with the underground sources, he replied that, in his judgment, this was underground water which had already been secured, and to take which people possessed established rights; but 250,000,000 gallons per day might be drawn from the various streams.

Examined by Sir A. GEIKIE, witness said he had considered the fitness of the Lea Valley for the construction of storeage reservoirs, and there were sites on which these might be erected. He had not personally made a survey of them. Schemes had, however, been brought out by others; and he had no doubt that there were certain places on the Lea and its tributaries where the works could be carried out. Asked what the effect of the pumping in the Lea Valley was, he mentioned that it only affected wells in the immediate neighbourhood; it had no effect on the great store of water in the chalk itself. He knew this because they had the records of wells in the neighbourhood outside the limits of pumping, and these wells were liable to occasional fluctuations; but there was no great fall in the water.

Sir A. GEIKIE: Are you aware of any examples where the effect of pumping has been to lower the water-level in wells?

Witness: Yes, certainly. I have made observations in large districts, and the effect of pumping is to lower the reservoir; but there is also a compensating effect—more room being created for storeage. So there is in great measure a balancing.

What led you to the 30,000,000 gallons a day which you speak of as being drawn from underground supplies in the basin of the Lea?—I arrived at it from having regard to the area of the watershed, and from my own gaugings carried on over a period of 16 years.

Supposing you take 30,000,000 gallons by pumping out of the valley of the Lea, what effect will that have on the stream?—Practically no effect, because the water is still going there, and if not pumped would run to waste. There are very few springs by which the stream is supplied from the chalk; and where there are any, they are at a higher point than the pumping, while the pumping has effect only on points below it, and there is nothing in the valley to be materially affected. Of course, if they were to pump more than the area yields, they would lower the chalk reservoir.

Examined as to the direction of the flow of the underground water in the chalk in the Lea Valley, witness said he believed, from observations he had made, that the water moved from the direction of the Colne and also down the valley directly. From other observations in various districts, he found that the yield of the chalk varied very much, no doubt through the chalk in some places being full of fissures, and so letting the water get away. He was attending to this in his present calculations. Coming next to the water taken from the Thames, and being reminded that he assumed that the present quantity, and a very much larger one if necessary, could be taken, he stated that the result of his Thames gaugings for the Thames Sewage Discharge Commission, and of other calculations, was that, if needed, all the water coming down above the Water Companies' intakes might be abstracted. There were streams which came in below the intakes; and as all that would be required to maintain navigation would be sufficient water for lockage, these streams would supply it. As soon as they come into the tidal portion of the river, the upland water was of no consequence. This upland water was said to be necessary to get rid of the sewage; but it was nothing of the kind. Asked whether, in his opinion, there would be any necessity for making a storeage reservoir, he replied that, if one wished to have this water, it would be an advantage to have a reservoir; but it was not absolutely required.

* The evidence referred to appears immediately after the close of the report of this day's proceedings, p, 691.

He went on to admit that he had not considered directly the question of storeage reservoirs; but his acquaintance with the Thames Valley was such as to enable him, as an Engineer, to hold that the construction of these reservoirs was quite possible.

Professor DEWAR reminded witness of what he had said concerning the quality of river water, and of his observation that the result of freely publishing the description of the character of the water, given in the report of the Rivers Pollution Commission, had been greatly detrimental to river water supplies generally.

Witness explained that what he wished to convey was that a general impression had been made that river water, because of certain organic impurities in it, was totally unfit for domestic purposes—in fact, that a prejudice had been created by the report of the Commission against the use of river water generally.

May I not put it that this was owing to deficient knowledge as to the efficiency of modern filtration?—No doubt.

Then, provided the present knowledge as to filtration had been available at the time of the publication of the Rivers Pollution Commissioners' report, your view would be that the general opinion would have been decidedly not against the use of river water?—I should not like to say that.

Questioned next as to his opinion of river water, witness stated that he knew of no instance of such water, after being properly filtered, being deleterious in any way; but, on the contrary, he was acquainted with beneficial effects from consuming it. He referred to the river water supply at Calcutta. There the river was enormously polluted; bodies of persons who had died of cholera, small-pox, and other diseases, being thrown into it higher up. At Calcutta, however, the water was most efficiently filtered; and wherever it was afterwards used, cholera had practically disappeared. Proper filtration of river water removed dangerous impurities.

Dr. OGLE observed that, in his submitted statement, witness expressed strongly his opinion as to the effect of the flow down a river of water which had been polluted, and how it became purified; and he gave two special examples. He said: "When cholera visited this country in 1848-9, there were at least two examples in which the sewage of an infected town passed into a river and was used for the water supply of a lower town;" and then he proceeded to give the two—one being the case of Sheffield and Doncaster, and the other that of Birmingham and Bilston. The first of the cases witness gave in this way: "In the report of the General Board of Health on epidemic cholera, 1848-9, although cholera was rife in Sheffield, and the sewage of Sheffield was thrown into the Don, and the water of the Don was drunk at Doncaster, cholera was not transferred." He (Dr. Ogle) wished to know the authority for this. He had searched through the report of the General Board of Health, and he could find no statement to the effect that the sewage of Sheffield had gone into the Don cholera-polluted, and was drunk at Doncaster without causing any ill-effects.

Witness said the quotation was from a County Council report; and he only referred to the figures with regard to the report of the General Board of Health.

But I have the authoritative figures for cholera for 1848-9, and I find that, so far from Doncaster having escaped and Sheffield having suffered, the death-rate from cholera was twice as high in Doncaster as it was in Sheffield.—But it did not happen at the same date. It occurred in Doncaster before Sheffield. I do not at all dispute the fact, because I say Doncaster is one of those cases in which there is no filtration whatever—where the river water is extremely polluted with the sewage of both Sheffield and Rotherham. I wish to point out that the cholera did not come from Sheffield to Doncaster.

Dr. OGLE called attention to the fact that the other case that was given was as to Halifax, Dewsbury, and Wakefield; the following words occurring in the statement: "The whole of these places discharging their sewage into the river above the source of water supply of the latter place." He asked if this meant that Wakefield discharged sewage into the river above the point at which it took water.

Witness replied that it did so at the time referred to; and in the epidemic spoken of, the two upper towns—Halifax and Dewsbury—were more infected than Wakefield. Dr. Farr's report in 1866 was his authority for this—the supplement to the 29th report of the Registrar-General.

In reply to Mr. HILL, witness admitted that he spoke of the supply of water taken from the streams and rivers as showing a better result, as regarded the death-rate, than did water drawn from other sources; but he did not say that the water was the cause of the difference. He thought it only showed it played a very small part in these cases.

But it may play no part at all. The death-rate may arise from other causes. The death-rate in different parts of a town supplied with the same water will vary greatly. The water may have something to do with it; but it is spoken of here as if it were the sole cause, while there are many other causes?—Certainly.

Questioned by Sir G. B. BRUCE as to how he proposed to compensate any mills that might be injuriously affected by the abstraction of water for town supply purposes, witness said they would have to pay the mills to put up steam power in the place of the water power taken away.

In reply to Sir A. GEIKIE, witness repeated that he did not think the pumping in the valley of the Lea had had any injurious effect upon the mill power there. It affected only a very limited area; and the fluctuations to which the mills were subjected were seasonal.

Mr. HILL: What would you do, as respects the riparian owners on the streams, if you bought up the mills? What about the rights of the riparian owners quite irrespective of mills?

Witness: There would be always sufficient water. I do not think the streams would become dry.

Professor *H. Robinson* said he had been instructed, on behalf of the London Water Companies, to submit to the Commission his views as to the possibility of augmenting the water supply of the Metropolis by the conservation of the flow of the Thames during periods when there was an abundance of water for all purposes, in order that it might be utilized at the time of minimum flow. In his opinion, it was quite possible to accomplish this, and at the same time to effect an improvement in the river itself by the construction of a storeage reservoir in the Kennet Valley. Acting on the basis of Mr. Taylor's gaugings, he calculated that it would be possible, by constructing a reservoir, to store 45,000,000,000 gallons of water, which would give a minimum flow of 600,000,000 gallons per day. He had never carried out a work of such magnitude; but for the last 30 years, he had had experience in practical work.

The CHAIRMAN: I will leave more competent men than myself to ask you questions about it; but I am not wrong, am I, in saying that your plan involves the diversion of some miles of canal, the submersion of two villages, 10½ miles of railway (including three stations), several miles of public roads, and private residences?

Witness said that was so; and it was set out in detail in his report. The top-water level of the proposed reservoir would be 230 feet above Ordnance datum; so that it would be impossible for the water to come by gravitation to London, but it must come down the river. This would enable the Water Companies to take out of the river 300,000,000 gallons daily, and give back to it 3,000,000 gallons a day. It had been stated in terms that it was impossible to make a reservoir in the Thames Valley; and therefore he had thought it his duty to investigate the subject sufficiently closely to show that there was no physical or engineering reason why such a reservoir should not be constructed. By elaborate sections, he had given in the fullest possible way the results of that investigation. The cost would not exceed £3,000,000; and it would include all the works to which reference had been made, with abundant compensation for all the injury to property and the valuation of the whole area. The proposal was to have two reservoirs—an upper and a lower one; and the present communication across the valley would be maintained by a bank which separated the two reservoirs. The reservoirs would be situated in the Kennet Valley, and would afford provision for a future population of 10,000,000, which seemed to meet the condition of things that could be reasonably contemplated by the Commission. He put the scheme forward also with the view to improving the condition of the river, producing a better flow than hitherto in times of drought; but if it was considered that such an improvement was not necessary, it would follow that they would have a larger amount of water than the 300,000,000 gallons available for the population. The rainfall on that area was about 30 inches, which was considerably above the average of the Thames Valley. The gathering-ground from which the Kennet reservoir would be supplied was 350 square miles; and the average annual discharge of the River Kennet might safely be taken at about 10 inches on the entire gathering-ground. About five-sixths of the 350 square miles was chalk. The total area of the reservoirs would be about ten square miles. Asked what sort of security he thought he would have in that area that it would be water-tight, unless he was sure of its being all London clay, witness replied that he had no hesitation in saying that the Kennet Valley would be perfectly water-tight for the whole of that area. Having in view that very question, he had taken the greatest possible pains before coming to a conclusion on the point; and the geological section showed conclusively that the mottled clay which underlies the London clay, extended over the entire area. There was no place, except the small basement bed of the London clay, the existence of which indicated the junction between the clay and the Reading beds, to which exception could be taken; and he had anticipated the objection that this would be a water-bearing bed, and must be dealt with accordingly, by proposing the construction of a puddled tunnel. It would not be a shallow reservoir, but rather the contrary, as the London clay rose on both sides of the Kennet Valley very steeply, which made it exceptionally favourable for the construction of a reservoir. He had also in his report referred very shortly to a scheme for a supplementary supply of water from Hampshire and Wiltshire, which would cost £5,000,000; but he imagined this was outside the province of the Commission to consider. The object was that, if they wished to provide for a very much larger population, or a very much greater proportion of water than 30 gallons per head per day, they would have this further stand-by in the future, by which, for £5,000,000, they could obtain an additional 147,000,000 gallons a day.

Mr. HILL: With the water getting into the chalk, how can you tell that it will ever come down to your reservoir?

Witness said that, if they looked at the line of saturation in the chalk, according to the sections of the wells, they would see that the line of saturation was quite clear, and that the water falling on that area would be thrown into the valley.

Referring to the embankment which is to constitute this reservoir, at the embankment itself you propose two wing trenches. In one direction, I suppose, the trench would be about a mile or a mile and a half, until you reached the mottled clay; and, in the other direction, you say it would extend seven miles, but you would only propose to go two out of the seven?—Yes.

And you would take your chance then whether the water would pass round the end?—Certainly. What you want to do is to bring the hydraulic gradient down to a point; and I have taken 10 feet to the mile to bring it down, so that the water could not travel. This would prevent any leakage. The general travel of the water in that stratum throughout the whole of the district is that of a hydraulic gradient of 15 to 30 and 40 feet to the mile; and where you get the 15 feet to the mile, there is a very slight quantity of water yielded by this thin layer. Whatever tendency there might be for water to travel (and in my opinion no water will travel at all, even in the first instance) through that thin bed, would be diminished slowly by the closing up of the pores in that very thin layer; so that I say, by putting this puddle tunnel in that short distance, and by reducing the hydraulic gradient to 10 feet to the mile, you bring to a minimum the possibility of the travel of the water through that pervious bed—in fact, it vanishes. The puddle tunnels would be an excavation—a drift about 20 feet high by 8 feet wide, sufficient to perfectly close the thin layer of clay. The tunnel, when driven, would be filled with puddle, worked by shafts from the surface, and the excavation made under the ground in the form of drift or tunnel, and that tunnel would be closed.

Do you know that if you put in 20 feet of clay—I do not care how tight you put it in—it will eventually settle down; and when you fancy you have got the puddle tight up against the crown of the tunnel, you will find, in course of time, that it gradually settles away from it, and the water passes?—Certainly; and I should provide for that. That

tunnel would be a work of considerable time; but that is, of course, a matter of care in the execution of the work.

Do you not think that cutting what we call "arm trenches," open from the surface, would be much better than putting in a tunnel?—I do not think so. In some cases it might be an open cutting; but I believe that at the other parts it would be cheaper to do it by means of a tunnel—by shafts.

Supposing you should discover, in the execution of this work, that the mottled bed of clay does not extend over the area, what have you below it?—I rely upon that mottled bed of clay—that is the basis.

Witness was further examined by Sir A. GEIKIE as to the basis of his conclusions with respect to the existence of the mottled clay at the bottom of the reservoir; and he expressed himself with perfect confidence on that point—submitting a number of sections to justify his conclusion.

Mr. *A. R. Binnie*, M.Inst.C.E., the Chief Engineer to the London County Council, was recalled to speak to a statement handed in some time ago, and postponed until the engineering section of the evidence was reached. He handed in a list of wells divided into three categories—those on the north side of the Thames within the county of London, those on the south side within the same county, and those on the north and south sides outside the county. He stated that his investigation had reference to the present condition of 172 wells, some of which were disused; and that he called special attention to the fact that the water-level varied considerably in all of them, not only at different times, but in contiguous wells at the same period. This showed, first, that well-sinking in the London area must always be more or less a matter of chance; and, secondly, that the water, when met with, flowed in certain definite but undefined lines underground, either in fissures or in some other way. Many of the wells had turned out to have run dry, partly by the lowering of the water-level, and partly probably through there not being sufficient water in some of them.

The CHAIRMAN: You contend, on the evidence before us, that there has been a fall of the water-level in the chalk under London?

Witness replied that this undoubtedly had taken place—a general fall, as near as he could discover, of about a foot per annum since 1840.

Do you wish us to say that in the chalk under London the level of saturation is 52 feet lower now than in 1840?—Certainly, in some cases; and more so in others. That is the average fall. I daresay it is subject to variations. It does not fall regularly from year to year.

Questioned further as to the water-levels in the wells, witness remarked that he only wished to say that the level was exceedingly low—at the present time very far (as much as 112 feet) below high-water mark. There was, he had pointed out, a marked area of depression in the neighbourhood of the City of London, where the water-level in certain wells was depressed to about 100 feet below Ordnance datum, or 112½ feet below Trinity high-water mark. Then he had proceeded to say that, from this point of depression, the level seemed to rise, although there were great exceptions. One well at the Zoological Gardens appeared to be depressed 80 or 90 feet below Ordnance datum; one at Islington, 95 feet below; while another, at the Shoreditch Workhouse, was 87 feet below. In Spitalfields, one at a brewery was 239 feet below; and another, at a brewery in Whitechapel, was 171 feet below. The well at the Royal Mint was 98 feet below; and on the other side of the river, the water in the Bethlehem Hospital well stood at 126 feet. The general inference was that the quantity of available water in the immediate basin of the London chalk was becoming exhausted. Asked if the chalk under London was necessarily connected with the sources of supply upon which the Water Companies might intend to draw in the future, he said it might be so. In his notes, he had thrown out a suggestion that possibly the depression of the water-level under London might be caused by the pumping of the Water Companies—in the Lea Valley, for instance. An engineer could only put this forward as a suggestion—could only speak of it as one of the possibilities which must be taken into account in reviewing the somewhat obscure and confusing state of affairs. This was one of the difficulties that arose in dealing with this well subject—that it was surrounded with obscurities. They could not possibly say, when a well was sunk, at what level they would actually reach the water, and what quantity of water they could get. Proceeding, he pointed out that he had compared the falling off of water in wells near the centre of the London basin and those in the outskirts; and, taking the former, he noticed that in one case the loss had been 79 feet in 33 years, and in another case 14 feet in 20 years. Asked to go to the Lea Valley and towards the outcrop where they approached the chalk, he mentioned that he was unable to get the information he wanted, either from the Water Companies or anybody else. His attention then being directed to a well at Camberwell, where there had been a gain of several feet in five years, he mentioned that he made a note of the gains, and said he hardly thought it was attributable to water from the chalk. He had reason for supposing that water was received from the sand formation above. But all the cases seemed to indicate that the greater losses were in the centre of the London basin, and that, as they proceeded from the centre, the loss became less; and the falling-away was no doubt attributable to the distance the water had to travel from where the outcrop was, and to the pumping of water in the chalk. But, he added, he believed the lower level in the London wells was due mainly to excessive pumping.

Sir A. GEIKIE put some questions to witness as to the possibility of obtaining a much larger supply of water for the Metropolis.

Witness, in reply, said he could scarcely agree with the statement regarding the possibility of getting an additional supply of water from the underground wells in the valleys around London. It was likely a portion of it might be so obtained; but then it must be at the expense of the water-level in the valleys, and possibly of drying up the principal streams which now flowed down into the rivers in dry weather.

In the course of your investigations in connection with these wells, did you arrive at an opinion yourself as to any means by which, judging from the general character of the wells or chalk in the neighbourhood, one could form a forecast as to whether a new boring for water would or would not be successful?—That is unfortunately where I have failed. I have tried to form an idea; but my data have failed me. I have no positive evidence to show that any well sunk in a particular position will yield so many million gallons a day. So that, he admitted, his opinion as regarded the amount of water available from chalk wells in the neighbourhood of London was very vague. But he thought anybody's would be.

In reply to Dr. OGLE, witness repeated his opinion that the Thames and the Lea should be discarded as sources of supply, and the water derived from some other source beyond the possibility of the contamination to which these rivers were subject. He added that he was not forgetful of the enormous area of unoccupied and uncultivated ground that would become necessary to provide London's future supply. He expressed a general opinion against the formation of storeage reservoirs in the valley of the Thames after having visited the valleys; and he asked that, when the Commission should have (as he believed they would have, in the course of time) a detailed proposal for the construction of certain reservoirs, he should be allowed to return and give his reasons for objecting to them.

The CHAIRMAN said the Commission would consider the point. But they had to form their opinion upon the evidence presented to them; and they did not desire to open the door voluntarily to answer and re-answer, if they could possibly avoid it.

In further examination by the CHAIRMAN, witness said there were one or two sites in the Thames Valley where a storeage reservoir might be constructed; but it would be at great risk and considerable expense. He would not say that a reservoir could not be made; but no series of reservoirs could be constructed of sufficient extent to supply London. It had come to his knowledge unofficially that nine reservoirs were to be proposed. Seven of these he held could not be built at all; and of the remaining two, one would be carried out at great risk and expense, and possibly when finished would not be water-tight, while the other could be constructed and filled with water, but would be in a swamp, and totally unfit for its purpose.

Sir *E. Easton*, examined by the CHAIRMAN, said he had designed and constructed upwards of fifty water-works, and had had special opportunities of becoming acquainted with the wants of the districts included in the scope of the inquiry. He expressed the opinion that a much larger quantity of the rain which fell upon the surface of the chalk was absorbed, and much more passed away from it by hidden outlets, than had generally been estimated; while the time during which the water remained in the chalk was considerably shorter than was generally supposed. Consequently there was no such thing as storeage for years, or even for many months. He illustrated this by diagrams from works at Brighton and Wisbech. He was of opinion that a very much larger quantity of water might be obtained from the chalk in the Kent, East London, and New River districts by means of tunnels intercepting the streams flowing through fissures and channels into the bed of the Thames, which was the practice adopted by the Gravesend Company.

Mr. HILL: How do you account for the water passing from the sea-coast, and the continuous depressions there in the chalk? Why does it not fill up?

Witness: That is a great puzzle; but it is a fact that the water under London has gone down. I have had to deal with perhaps 50 wells in London, and have now several in hand; but I think the cause is the water being prevented from getting into the chalk under London for some geological reason with which I am not acquainted. Whether or not it is, as some geologists have said, the superincumbent weight above of the clays which have altered it, I do not know; but at all events the analysis of the water shows that it is from a different stratum. The well near Trafalgar Square, which always yields 250,000 gallons a day, gives very soft water, as does also the Bank of England well, and the wells at the Mint and the Reform Club. On the other hand, the Langham Hotel well and the well at the Lion Brewery, where they pump 200,000 or 250,000 gallons of water every day, yields hard or chalk water. Something has therefore happened under London which has changed the level. At Fulham Palace, the spring which used to come up as a fountain when sinking was begun in 1822, has now gone down 60 or 70 feet.

In reply to Dr. OGLE, witness said it was possible, by the adoption of proper fittings, and removing sources of waste, that a considerable saving might be effected, and that 7 or 8 gallons a day reduction might be made, which would leave from 18 to 20 gallons per head for domestic supply. There should be no stinting of water; and he thought the streets of London should be washed every day, as they were in Paris.

Sir A. GEIKIE: Do you base the opinion that the water remains in the chalk a much shorter time than is generally supposed, and that there is no such thing as storeage for years, or even for months, upon the oscillation of the water-levels in the chalk?

Witness said that was so, as shown in a diagram which he produced. They knew that the water was running into the sea, and that there could be no storeage. There possibly was a storeage under London; but they did not know what it was. It was not worth much, because probably a great deal was not to be obtained from it.

The Evidence of Sir George Buchanan.

The following is the corrected report of the evidence given by Sir G. Buchanan, M.D., F.R.S., at a private sitting of the Commissioners on the 10th of May last, to which reference was made by the Chairman at the opening of the proceedings on the 6th inst.:—

Sir *G. Buchanan*, M.D., F.R.S., called and examined.

The CHAIRMAN: You have been made generally familiar with the object of our asking you to come here to-day. One of the questions which we have to inquire into is the adequacy of the quality of the present supply of water to London; and we have had some discussion as to how that adequacy is to be tested. We know what a long experience you have had in these matters; and we are anxious to learn whether you have any suggestions to offer, in a general way in the first instance, and then we shall ask you perhaps, some specific questions afterwards.

Witness: I should say that, as regards the water supply of the Metropolis, I have no special information about it. The investigations I have made have been for the most part in cases of water supply elsewhere than in the Metropolis.

What investigations do you refer to particularly?—They are of two kinds. First, we have had investigations by the application of common tests, principally chemical; and, secondly, into the cases of water inculpated, or supposed to be inculpated, in epidemic outbreaks, which have usually been outbreaks of typhoid.

What do you call the common tests?—I should mention, as probably being the best of them, the tests used by Dr. Frankland, for the determination of organic impurities.

Are you referring to tests to find out the chemical quality of the water?—Tests of the chemical quality of the water; they are the tests that are more frequently made for us.

We have had that department of the inquiry before us, and discussed it; but we are more anxious, I think I may say, to find out how, in your opinion, it is possible to apply any test to water supplied for consumption, not so much as regards its chemical qualities, but as regarding the question whether organisms hurtful to the human species exist in it after filtration?—I think I should say that I have no evidence on the subject.

You referred just now to an epidemic of typhoid, for example. You were sent down, I understand, to test the water—to find out whether the typhoid outbreak was due to the water?—Yes; that was included in the investigation.

In a case of that kind, if suspicion had been directed to the water supply, what would you proceed to do?—To disuse the water, or to boil it.

But that would not tell you, except indirectly, whether the water was responsible?—We should not have trusted to any test whatever for evidence of the water being responsible.

Sir A. GEIKIE: Any test that you have applied, such as the albuminoid test, was simply to ascertain the amount of nitrogenous matter in the water, or something of that kind, was it not; it had nothing to do with actual germs of disease?

Witness: Not at all.

Whether there was a certain amount of poisonous organic matter?—Yes; that is precisely the distinction I should draw. There were certain chemical qualities ascertained; but the pathogenic qualities were not distinguished.

But those chemical qualities very often go with pathogenical qualities. You know that, when those chemical qualities are there, there is a probability that there are some germs of disease there also?—There is an indication that the water is impure, or has some presumably undesirable material in it.

The CHAIRMAN: Have you had an investigation of that kind recently?

Witness: I have here certain papers contained in one of my more recent reports. I think they are worth having before you [producing the Annual Report of the Medical Officer of the Local Government Board for 1889]. Perhaps I may call your attention to the particular thing that strikes me as interesting for you. At p. 70 you will see some records of water analysis; and I would ask your attention to analyses of sample C and sample E, and to an analysis of another sample on p. 71. They are made by different analysts; sample C by Mr. Pattinson, sample E by Mr. Stock, and the analysis on p. 71 by Dr. Dupré. Now, the interesting point is that all those three samples were taken at the same time, and collected in the same way, for the same purpose, and at the same place. The different reports of these analysts are worth noting.

What inference do you draw from them?—I think the principal inference to draw is that chemical analysis has failed to give much information to Mr. Pattinson—so little information, that he speaks of the water being "very free from organic contamination, and quite suitable for drinking purposes;" whereas the same water, collected at the same time, and called sample E, submitted to Mr. Stock, is spoken of as "not satisfactory as a drinking water," and Mr. Stock says: "I consider the ammonia to be evidence of recent sewage pollution. I take this item in connection with the microscopical examination, which is of sufficiently suggestive character. I am distinctly of opinion that, unless a very satisfactory explanation of the presence of ammonia to which I allude is forthcoming, the water cannot be considered a safe water for public supply." The conclusion that Dr. Dupré arrives at is something to the same effect.

Did all these gentlemen start with the same initial knowledge of the water?—Presumably that was the case. Mr. Stock says: "I have no knowledge whatever of the origin of the sample; and I give my opinion apart from any outside consideration, as I am clearly bound to do." There is no evidence that Mr. Pattinson knew anything about the origin of the sample; and I think we may take it for granted, from the common practice of the Local Government Board's Inspectors, that Dr. Dupré did not know. So that, probably the three analyses were made apart from any initial knowledge.

In a case of this kind are any general rules laid down as to the tests which the analysts shall apply, the trouble they shall take, and the expense they shall go to, or is each analyst left to do exactly what he likes?—The only one of these gentlemen who was employed by the Local Government Board was Dr. Dupré. The analyses made by the other chemists were for the Local Authority.

Was the Local Authority interested one way or another?—No. As far as I understand, they were anxious to know how they came to have such a lot of enteric fever.

Sir George Bruce calls my attention to the fact that, in the headings of examples A, B, C, D, and E, different dates are given?—That is true; those are the times when the reports and analyses were sent in. You will find the statement about the collection of the water at p. 68: "Samples taken on May 7 directly out of the reservoir had been submitted to" the three chemists; they were taken from the same place and at the same time.

Do I understand that you wish me to draw the inference that chemical analyses of this kind are untrustworthy?—I should say rather that the analyses have given no information to one of the analysts, and have given some information to the others. It was a question of interpretation, in large measure; and I think also a question of observation.

But does it resolve itself into more than this—that persons of varying degrees of experience (to put it in no way offensively), or I might say of skill, will arrive at different results?—That is no doubt the first inference to be drawn as between the two.

But you do not mean this, do you—that two persons of equal skill, and using the same tests on two samples of water taken at the same time and in the same place, and in every way fairly, will arrive at different results?—I think they do not arrive at very different results. The difference is rather of interpretation of the results. You will find, I think, very similar results in regard to samples C and E.

Do you think so—because sample C is said to be "colourless and nearly clear;" sample E is said to be "faint green and slightly milky"?—That is what I consider a difference of observation.

Professor DEWAR: What I take it Sir George Buchanan means to convey is, that, as to the actual results of the individual analyses—such as the amount of chlorine, the amount of ammonia, the amount of oxygen absorbed, and the total solids—all the analysts give approximately the same results, but that they interpret them in a different way?

Witness: That is what I mean; and one of them has been helped by a microscopical examination.

He subsidized his chemical examination by a microscopical examination?—Exactly; the other chemist professes to have made a microscopical observation, and has made it very ineffectively.

The only difference is in the case of the analysis of Dr. Dupré. His ammonia there is 0·0092, as it appears; but, of course, his results are expressed in grains per gallon?—That is so.

The CHAIRMAN: Supposing a sample of water said to be a fair specimen of what was being delivered by a public company were shown to you, what tests would it be possible for you to apply, or what tests would you advise others to apply, to find out whether there were organisms in it deleterious to human life or health?

Witness: I know of none that I should trust. I should examine, no doubt, to see whether there were organisms visible to my microscope, as well as take account of the albuminoid ammonia and nitrates, and such other materials as there are in the water. I should consider each and all of these chemical data as bearing on the general question of the water having received impurity. But that the water contained any impurity that was injurious to health would be a matter I should confess myself unable to determine by any such analysis or microscopical examination.

Do I understand that you would carry that further, and say that no analysis whatever of any sample of water could give you a true clue to whether the water so supplied did or did not contain, if supplied in large quantities, hurtful organisms?—I think it would give me no information as to the hurtfulness of the organisms. May I illustrate my difficulty by some data given in the last Annual Summary presented by the Registrar-General? Dr. Frankland has something to tell us each month of the number of microbe colonies that he finds in the London water supplies. Let us note, for example, his record of Southwark water. In January, 2088 microbe colonies were developed from each cubic centimetre of this water; in August, 26. So that in one month there were nearly 100 times more microbe colonies than in the other month. Nobody can believe, or would think of believing, that there was 100 times the danger from microbes in the Southwark water in January as compared with what there was in August.

Sir G. B. BRUCE: Do you mean that that analysis was not correct?

Witness: Oh, not at all. I should take it for granted that, according to the processes that were used by him, the examination was correctly made and correctly reported upon by Dr. Frankland.

Then it was the processes that were at fault?—The processes were of no earthly value for the demonstration of morbid elements.

Do you mean that, if you discover a certain large quantity of bacteria or anything else in water of that class, it will not guide you at all as to the fitness of the water for drinking?—With my present knowledge, I should prefer to have water with absolutely no organisms in it.

But you would not be afraid to drink it if it were pretty full?—It would depend altogether upon the nature of these things; and I could not determine that, either by analysis or by the microscope.

There is no means of determining, is there, the class of animalculæ that are in the water?—Not at present; at all events, not of determining their relative harmfulness. Whether or not we shall have them ultimately, I do not know; but we certainly have not the means of distinguishing them now.

Then tests pursued in that direction, with our present knowledge, would not give us any useful result; is that what we are to gather?—At present I am afraid that is true.

Then you would not suggest to the Commission the advisability of carrying out tests in a certain particular line, because you believe that the result, with our present knowledge, would not be to give us any practical information?—I should say that it might be worth while to invent tests—to work up the whole subject—both for the discovery of chemical tests and for the better determination of what was morbific among the microscopic organisms. It might be worth while to do that; but it would be a very long business. We certainly have not adequate information at present.

Mr. HILL: Do you place much dependence upon the sources from which water is obtained, or simply take the water as you find it?

Witness: I may say that the interest of the Medical Department in respect of any given specimen of water consists, almost exclusively, in learning about the sources of water. If we have to investigate the quality of a water, we care about where the water comes from, and what it has encountered on its way to the place of its delivery. I do not think we care greatly about much else.

Mr. MANSERGH: Its history, in fact?

Witness: Its history.

We find from the reports of your Department, that by filtration a very large proportion—98 or 99 per cent.—of all the micro-organisms are removed by filtration. Do you think we could have experiments conducted of this sort. Get the dejecta of typhoid or small-pox patients, mix it with a proper quantity of water, and filter it, and then test for the result? Do you think we could learn anything useful from that?—You would probably find that you got rid of some such proportion.

Supposing that water, before being submitted to an analysis, were allowed to stand for (say) three or four days, and then be filtered; what result do you think we should get then?—You would get less of these elements in it.

Is it possible that they might all be gone?—I should think not. From what I understand of the efficiency of any filtration that has yet been devised, I should not be confident about the absolute removal of

microbes of every description from water that had once been infected or made impure by them.

I purposely added, "the water being allowed to stand for three or four days." Do you think that would have any effect in removing these organisms, with the filtration added?—I would rather you obtained evidence on that point from people who have made the observations for themselves. I have never known evidence of all microbes having been absolutely removed, though I am aware that Dr. Frankland can record the absence of any microbe colonies—that is, of microbes which will, at the moment of the experiment, consent to grow into colonies under the conditions of his experiment.

The CHAIRMAN: The point put to you was whether that would be a useful form of inquiry?

Witness: Certainly, I think it would be very well worth while to try it; but I have not heard of any success attending attempts of that kind yet. Perhaps the Commission knows that certain experiments have been made in my Department (I mean, of course, my old Department), with purposely polluted water, in order to see what the result of a chemical investigation would be.

Mr. MANSERGH: The ordinary chemical examination, you mean?

Witness: The ordinary chemical investigation was applied to it; and the result was that the chemical results gave us very little information about the characters of the water. It was certain that we had rendered the water a very dangerous one; but the chemists did not succeed in telling us what the danger was.

I was rather thinking of cultivation?—Whether or not that was attempted I cannot say; but doubtless those inquiries did not embrace the problem as it might now-a-days present itself to us—namely: Given a water that had been purposely made impure, to try whether sufficiently repeated filtration could succeed in removing all microbes, their spores and all, that had been previously introduced into it. Nor was such experiment made with Clark's softening process applied to such water. No doubt that would carry down a large quantity of microphytic elements.

Professor DEWAR: I think you had a number of experiments made with regard to the life of several of these micro-organisms in potable waters. Did not Dr. Sanderson and Dr. Klein carry out some inquiry?

Witness: Dr. Sanderson carried out some inquiry of the kind. But it was many years ago; and I think Dr. Sanderson would now have something more to tell you about it, probably, than he had then.

That is why I put the question. I was under the impression that Dr. Sanderson had conducted inquiries, at your instigation, as to the life of several of these micro-organisms in potable waters?—Such an inquiry by Dr. Sanderson, I think, would rather have been in Sir J. Simon's time.

As far back as that?—Yes, if by Dr. Sanderson. But since then some observations by Dr. Dupré have been made respecting the life-processes in water of bacteria that had been purposely added, in order to see what could be made of their chemistry.

That was more especially with regard to the products?—No; I think it was rather the behaviour of them towards oxygen.

That was a question, I think, with regard to the aëration of waters?—Yes; the observations bore upon that question.

You can give us all these references?—Yes. In the reports of 1884 and 1885, the question is considered and reported upon by Dr. Dupré.

Sir G. B. BRUCE: What reports are these?

Witness: The annual reports of the Medical Officer.

Professor DEWAR: That is, where there was a great deal of discussion with regard to the aëration of the Thames.

Witness: I will read the passages I refer to. The first is from my report of 1884. Speaking of Dr. Dupré's observations, I say:—

> Some very important experiments made for the Department by Dr. Dupré during the year appear to indicate that microphytes in potable water may be recognizable as such by the chemist. These organisms have not hitherto been distinguishable from an equal quantity of dead organic matter polluting a water. But it would seem that during their active existence in water they have the property of consuming oxygen for their own life-processes, deriving such oxygen from the air dissolved in the water. Therefore, by observing whether or not, during keeping, there occurs a change in the amount of oxygen present in the dissolved air of a water, the presence or absence of growing microphytes can be established; and by observing the extent of change, the amount and activity of any microphytic impurity may be judged of. Dr. Dupré's paper sets forth the methods of making such observation with due avoidance of error, and states the experiments and the control experiments upon which his conclusions are based. He indicates also the way in which we should seek to recognize micro-organisms in their spore state, and by which we may even expect to be able to distinguish between one kind of microphyte and another.

That is one of the matters you were questioning me about.

> A similar line of research has been indicated by Dr. Angus Smith shortly before his lamented death. Dr. Dupré's researches appear to form a new departure in our methods of recognizing the characters of water for sanitary purposes. So you will see that I attach importance to them.

Has that been followed out?—That was followed out in the next year; but I am sorry to say we had too many demands on the limited purse that is given to us by Parliament to continue these investigations. We had other things that were more pressing and urgent; and we did not continue them as we ought to have done. The second report by Dr. Dupré is also a suggestive one.

I do not think there is anything new in the second report; it merely bears on the absorption of oxygen by micro-organisms?—No doubt.

This is merely a proof of what has been accumulating for years—that any oxidation that takes place in streams is mainly due to the action of micro-organisms. Is not that so?—Yes; but Dr. Dupré's observations went to indicate differences among the bacteria.

In the rate?—Differences in the amount of oxygen consumed by different bacteria.

Of course, if the bacteria did not belong to that variety that could pass over oxygen, then it would give no results. I wanted to know whether any of the pathogenic organisms assumed to be connected (say) with typhoid fever, or any other, had been tried in this way. That is, of course, an essential point?—Experiments were made with Chelsea water boiled, Chelsea water to which a certain quantity of ordinary London sewage had been added, Chelsea water to which Finkler's *comma bacillus* had been added, and Chelsea water to which the *bacillus subtilis* had been added. These were cultivated under different conditions of temperature, and were compared with Trafalgar Square water and the Kent Company's water. That was the nature of the investigation.

And they all had the property of transferring or absorbing oxygen in this way?—In different degrees; and the differences were recorded by Dr. Dupré as being significant.

The rate of change, the rate of absorption of oxygen under different conditions?—Under different conditions of temperature. Then I would refer you to this passage in my report for 1885 (I am showing how greatly we need research into the ways of harmless bacteria, as well as into the habits of those which produce disease)—

> Looking at the prodigious part that bacterial life plays in the economy of Nature, it is hardly too much to expect that morbific bacteria may come hereafter to be known, not merely as producing disease under certain conditions, but as having under other conditions many other functions in that economy. When such bacteria are so circumstanced that they can produce disease, the best thing we can now do may be to poison or boil them; but while provisionally we use such resources, science may expect hereafter to see beyond them. The larger aim of sanitary science in relation to each harmful bacterium will be to turn against it such forces of Nature as are customarily antagonistic to it. The termination of a case of infectious disease by recovery of the individual, the end of an epidemic in the community, the limitation of area over which infection spreads, of the length of stream along which it can be carried, all point to the existence of such forces. It has long appeared to pathologists that, among agencies antagonistic to the bacteria of disease, none will be found to equal in potency the agency of other bacteria; that probably the "self-purifying" power of our rivers, for example, is the power of some stronger septic bacterium to destroy the weaker and more mischievous bacteria which are discharged by sewers into our rivers. So that if, among bacteria as among higher creatures, natural hostilities of that sort result in the destruction or repression, supercession or assimilation, of the weaker by the stronger organism, the study of such hostilities is the study to which we may most hopefully appeal for resources against the forms of bacterial life which we now only know as agencies of disease. At present we know too little of the natural history of this class of organisms. We recognize among them differences of form; differences in the mode of their growth, in the mode of their reproduction; differences, as we believe, in the degree of their dependence upon air, and in their resistance to one and another degree of heat, in their effect upon this or that chemical substance, and *vice versâ*. But we know very little more than this, and practically nothing of the means by which any bacterium exerts its influence in the production of a chemical change or of a disease. Yet if we are to understand the part that bacteria play in the production of disease, and if, in our endeavours to prevent and modify bacterial disease, we may hope for the aid of other bacteria and of like beings, we require extended and exact knowledge of their life-history; of their characters, qualities, and habits; of their abilities, affinities, and antagonisms. And this knowledge we need, not alone for those which, under some circumstances of their existence, may be competent to produce disease, but also in respect of those which are harmless, and which may, if rightly utilized, be of avail to us in repressing disease.

You mentioned the number of micro-organisms returned in January as being 2088, as compared with August, when they amounted to 26; and you pointed out the almost absurdity of supposing that the amount of damage was in proportion to the ratio of these micro-organisms. Now, have you any indirect proof, or has your Department made any analysis with regard to the distribution of disease in connection with any of the London water supplies?—In the case of London water supplies, I think the only analyses that have been made for us have been by Dr. Frankland.

I did not refer to the chemical analyses; I meant an analysis of the distribution of particular types of epidemic disease, as compared with the condition of London water, or in different districts of London?—No, not on any scale. The matter was investigated at the time of the East London outbreak; and it was possible to identify the distribution of cholera with the distribution of water from certain reservoirs at Old Ford. The investigation for the rest has not been made in London; partly for the reason that we have not had so much to do with the health of London, compared with what we have had to do with that of the provinces. London has had very little of our investigation. When there has been a curious piece of scandal, such as eels being found in water-mains, our Department, as the only scientific sanitary department at the disposal of the Government, has been asked to investigate it. In that instance, we found that the eels walked up the river banks, and so gained access to reservoirs of filtered water. No one seemed to know of the ability of eels to walk up grass-slopes, until one of our inspectors stated it. Again, we of the Medical Department have had occasion lately to find out some risks, as we think, to the water of the Thames, due to the circumstances of extra-Metropolitan districts. I refer to the condition of the subsoil in the Staines sanitary district, which constitutes a danger that we think is very probably being incurred by London. But we have not followed that up at all. It is a matter that probably this Commission will be interested in.

The CHAIRMAN: We are very much interested in it; but we want to know how to investigate it?

Witness: There is nothing for it, I think, but to go and look after it in districts on the banks of the Thames where such conditions can, by possibility, exist.

The question is, how we are to apply a test which will be not a mere rule-of-thumb test, but one which we can expect other people to see the value of. That is just the very kernel of the question which we want you to help us in?—I am afraid there is nothing for it but to go and look for such things as our inspector saw in the Staines rural district. If one sees a place in the river gravel riddled with cesspools, and the cesspools filling when the river is in flood and emptying when the river is not in flood, one knows very well that that is a dangerous condition of things; but I do not think that any tests, chemical or microscopical, that you could apply to the water taken from the Thames and delivered after filtration to the London population, would give you information as to the danger of the water.

Is it your position that water contaminated as you have just described, is contaminated in such a way that no amount of filtration or treatment will make it a safe source of domestic supply?—I should not quite say that, because I cannot say what the nature of the initial

pollution is. People may be drinking their own excrements or their neighbours' excrements, for all I know; they have repeatedly, and it has done them no particular harm. But there are occasions when those excrements get morbific qualities——

Can you give us any line by which you can distinguish the dangerous from those which are simply nasty; that is the point?

Mr. MANSERGH: Something more than the sentiment.

The CHAIRMAN: Quite so.

Witness: I should like to read you another passage from one of my reports. You will find that these things have been thought out very much. This passage is introductory to Dr. Cory's observations, that I referred you to just now. It is about observations made upon water purposely polluted with excrement:

If we could be sure that waste products contaminating water were by no possibility derivable from any but healthy bodies, we might perhaps run no very serious risk if our water were as foul as that of the Holy Well of Mecca—stuff saline with urine, and yielding to analysis "nearly six times as much animal matter as is found in the same volume of strong London sewage" (*Frankland*). But with the introduction of the idea of specific disease, the conditions are totally changed. We do not know how small a quantity of material that has been in relation with such disease may, when it gains admission to a healthy body, suffice to produce like disease in that body. We have no reason for believing that the quantity of disease-producing material in a water, or the likelihood of the water possessing harmful qualities, is proportionate to the total organic matter or to the total animal matter present in the water. The utmost that we have been able to say is, that there has been greater opportunity for the entrance of the material of disease into water that can be recognized by the chemist as foul with organic matter; and we have surmised that the material of disease on entering such water may obtain opportunity of sustaining or multiplying itself. . . . The lesson is taught afresh and significantly by Dr. Cory's report that, while we must ever be on the watch for the indications that chemistry affords of contaminating matters gaining access to our waters, we must (at any rate, until other methods of recognition are discovered) go beyond the laboratory for evidence of any drinking water being free from dangerous organic pollution. Unless the chemist is well acquainted with the origin and liabilities of the water he is examining, he is not justified in speaking of a water as "safe" or "wholesome," if it contain any trace whatever of organic matter; hardly, indeed, if it contains none of such matter appreciable by his very delicate methods. The chemist can, in brief, tell us of impurity and hazard, but not of purity and safety. For information about these, we must go, with the aid of what the chemist has been able to teach us, in search of the conditions surrounding watercourses and affecting water services.

This was written as introductory to the experiments that I spoke of; and the experiments I think very much confirmed our view that there was no way by which the chemist could distinguish what was harmful, even though it contained abundance of microbes, from organic matter that was harmless.

What was the date of that?—That was 1881.

Since then has anything fresh, within your knowledge, been elicited to confirm or to weaken that statement?—During those years the process of cultivation of microbes has been developed; but I hardly think the water analyst of to-day is in a better position than ten years ago for discriminating between harmless and harmful bacterial elements in water.

Professor DEWAR: Then, as I understand, you rather suggest that it would be inadvisable for the Commission to prosecute any research with regard to the newer methods. I am not speaking now of the plate cultivation merely of Koch, not the mere enumeration of the number of microbes; but do you think it would be impracticable for us to try and see whether pathogenic organisms can be found in filtered London water?—Beginning with London filtered water, and trying to investigate it?

Yes?—I think until you have got more developed methods, it will be no use trying. But you might devise methods by the opposite process of polluting sterile water with definite material under definite conditions; and then investigating from beginning to end the water that has been so prepared—the behaviour of the bacteria that developed in it, on plates of one and another sort of cultivating material, under different conditions of oxygen supply, temperature, and so forth. That you might thus ultimately get to a method of recognizing one form of bacteria from another, I can imagine; and if it were worth while to "invent" a process (as I called it before) in that way, it would avail you for application to your questions about London waters. But my proposal would be to begin by contriving better means of recognizing what I knew to exist.

I understand you to mean that you would rely far more upon a synthetical method than upon an analytical method of bacteriology; you would rather add the specific micro-organisms to the water, and study then the behaviour of the micro-organisms in it, than begin by trying to see whether they are actually present in the water?—Yes, in order to "invent" my process; and then I should have better knowledge available for studying the complex elements contained in a London Company's water.

Now I take you to the newer process. In one of the last numbers of Pasteur's *Journal*, there is a very important paper on the discussion of the condition of some potable supply. The method that has there been employed is, not merely using a small quantity, but as much as a litre of water; and the cultivation has been done in that large quantity of water by the addition of a certain amount of carbolic acid as an antiseptic, so as to reduce the percentage of the varieties of micro-organisms to one or two—in other words, to eliminate a large percentage, and simply to leave two, more especially the typhoid bacillus, which withstands that, and another bacillus. That is the new method. Do you think that some such attempt might not be made to see if these exist in London water?—You are telling me a number of things that are stated by Pasteur, about which I should begin by investigating the facts. If they are so, they are examples of the methods that are available for investigating the behaviour of London waters; but I do not know the facts that are stated in your question. I should not have been confident, for example, that I could identify by any method of the kind the particular bacillus of typhoid.

Of course, that is just the difficulty. It is alleged to be the same; but there is no experimental proof that it is so. It has all the characters, as found in Algiers, of the supposed *comma bacillus*, but there is no proof that it is still identical; and what I understand you to mean to say is that, as far as regards microscopical examination, there is no certain proof that the organism you select is the pathogenic one?

Sir G. B. BRUCE: Then you cannot detect what is injurious and what is not injurious; that is what I gather?

Witness: By chemical, microscopical, or bacteriological processes, I do not think you can.

Sir A. GEIKIE: I gather then, from what you say, that you attach more importance, with regard to the potability of water, to a chemical determination of the ammonia and the albuminoids than to any results likely to follow from the mere microscopical examination as at present possible. If we were to undertake any investigation, you think we should have more hope of detecting the deleterious qualities of the water by chemical than by microscopical examination, is that so?

Witness: As I said in 1881, chemistry can teach us of risk, but not of safety. I do not think you would get conclusive information with regard to the wholesomeness of a water by either a chemical or a microscopical investigation.

But I understood you to say that you would get definite information as to the amount of albumincid ammonia, and that that would put you on your guard against the possibility of contamination?—That would give you the facts about the ammonia; but no information about the wholesomeness of the water. It would only give you the information that the ammonia, if it comes from nitrogenous animal matter, has come from a source that is hazardous.

Then there is no particular line of research that you can suggest or recommend to the Commission?—I do not think there is anything but what I may call field observations—to go and see that what ought not to get into water does not get into it.

The CHAIRMAN: That is a reply that leads me back very much to an answer you gave to Mr. Hill a little time ago—that, when you commence a new investigation with a view to tracing the course of any specific disease, the first question is where the water comes from if you suspect it?

Witness: No; the first question concerns the reason there is for suspecting the water, whether there is any such distribution between the disease in matters of time and place and consumption——

Quite so. When suspicion is directed to the water, you then think what is the source of supply?—Then we should certainly look after the source of supply.

Having found this, if you think the source of supply is polluted, does it have any effect upon your mind; what is the treatment of the water after it is taken from the source?—No. I intended to say "No" to such a question, when I made the statement, in some previous answer, that I thought there was nothing for it but either to boil the polluted water, or else to leave it alone.

Is your own house within the Metropolitan area?—Yes.

Do you boil the water as it comes to you?—Not at all. I am perfectly content with it as it is.

Mr. MANSERGH: When you say leave it alone, you mean not use it?

Witness: Exactly.

The CHAIRMAN: Now, you have some more books there; is there any other point in regard to which you think any suggestion you could make would be of use to us?

Witness: There is one matter that I do not believe falls strictly within your province, but I cannot help thinking that you would like to know something about it; and that is, the danger that water gets—a danger that I imagine is a most formidable one at times—after it has left the filter-beds or sources of supply, and has got into companies' pipes—into the public pipes.

Before or after filtration?—After filtration, when it has been delivered as fit for consumption, and is sent into the pipes of the town or of the company. It runs a fresh risk altogether, a risk that may be a very formidable one indeed. I do not believe you have any commission to look after a point of that kind; but I cannot help thinking it must be worth your consideration in some way or other.

What is the special danger that you speak of?—The danger is, the risk that the water runs—the very serious risk that it runs—from the lateral insuction of liquids through broken and leaking water-pipes; the insuction into pipes that are laid in troughs common to them and to sewers, and so forth.

Have any specific instances, traced to that, been brought to your knowledge?—Yes, indeed most serious ones. Here is an account of an epidemic at a place in Wales called Mountain Ash. It is described in the seventeenth supplement to my report to the Board for 1887. It gives an account of a water supply sent to a number of villages. One branch of the water supply distributed enormous amounts of typhoid fever; while the other branches went on their way doing no harm to anybody. Here are places red with dots of typhoid cases, and affecting one particular branch; the others being free. The story is very well worth reading. It is very interesting, at any rate for anyone who likes to look at the investigation.

Is there any other point you think you could help us upon?—That is the only other thing that occurs to me at this moment.

Darwen Water Supply.—The Darwen Town Council have decided to apply to the Local Government Board for powers to borrow £15,000 for the extension and improvement of the water-works.

The Monte Video Gas and Water Companies.—The Directors of the Monte Video Gas Company recommend a further dividend of 10s. per share; making, with the interim dividend already paid, a total of 5 per cent. for the year. A sum of £8027 remains undivided. The Directors of the Monte Video Water Company have declared an interim dividend at the rate of 5 per cent. per annum for the six months ending June 30 last.

Additional Powers for the Neath Corporation Gas Department.—Last Tuesday, Mr. E. P. Burd, one of the Local Government Board Inspectors, held an inquiry at Neath in regard to an application by the Urban Sanitary Authority to the Local Government Board for a Provisional Order to amend the Corporation Gas Act of 1874, so as to empower the Town Council to borrow further money for the purposes of their gas undertaking, including the provision of working capital. There was no opposition; and very little interest was taker in the proceedings.

THE SHEFFIELD CORPORATION WATER-WORKS.

The Water Committee of the Sheffield Corporation recently made an inspection of their water-supply works at Bradfield; the chief object of their visit being to see the progress which has been made in the construction of the wing trench in the Damflask reservoir. This reservoir is by far the largest, and in some respects the most important of the reservoirs belonging to the Corporation; for, when brought into use, it will have a storeage capacity of 1,158,000,000 gallons, and the depth of water will be no less than 85 feet. The reservoir was completed some years ago—it was the last undertaken by the late Water Company; but, when the process of filling it with water was commenced, it was discovered that a band of rock on the south side was not water-tight, owing to its broken and fissured condition, and that the water escaped, to reappear as a spring at the bottom of the outer edge of the embankment. It therefore became necessary to adopt some means to prevent this percolation; and this is being done by cutting a trench (one portion of which is 100 feet deep) parallel with the public road which runs by the side of the reservoir, and at right angles to the main bank. The work of refilling the trench with water-tight material is now being proceeded with. The refilling comprises a "shoe" of concrete, with an internal layer or "core" of puddled clay; a rib of solid rock being left between the end of the wing trench and the main trench in the embankment, which will be rendered solid and water-tight by means of bore-holes filled in with Portland cement grout. Up to the present time the expenditure has been about £20,000; but what the total cost of the trench will be, it is, of course, impossible to say, as this depends in a great measure on the water-tight character of the shale excavated into towards the shallow end. If what is now being done should prove successful, this reservoir will add to the present available sources of supply no less than 3 million gallons of water per day. Sheffield will then have a total available supply of 10 million gallons a day—sufficient for the supply of a population of 500,000; the present rate of supply being a little more than 20 gallons per head per day.

A few general particulars relating to the Sheffield water supply will be interesting. The water is drawn from the elevated moorlands to the west and north-west of the town. The storeage reservoirs are divided into high and low level. The former, which supply the upper portions of the town, are the three at Redmires, which have a capacity of 670,000,000 gallons, and a gathering-ground of 2108 acres. Of these the upper reservoir is the largest; having a capacity equal to 343,000,000 gallons. The middle reservoir comes next, with a capacity of 187,000,000 gallons; and then the lower one, the capacity of which is 139,500,000 gallons. The lower-level reservoirs number six; two of them being in the Rivelin Valley, and the others (Damflask, Agden, Dale Dyke, and Strines) in the Loxley Valley. The supply for these is drawn from a gathering-ground of nearly 14,000 acres; and their united capacity totals up to 3,017,500,000 gallons. Taking both the high-level and the low-level reservoirs, the town has a gathering-ground of 15,703 acres, and a storeage capacity of 3,687,000,000 gallons. Large as these figures are, they do not include the sources of supply which are available in time to come. The present supply is sufficient, as already mentioned, for the requirements of a population of 500,000—a number not likely to be reached yet awhile; but the Directors of the late Water Company wisely looked to what might be required from them in the distant future. This they did by obtaining power to construct two reservoirs—the Broomhead and the Moorhall—in the valley of the River Ewden, which lies immediately north of the Loxley Valley. These will have a drainage area of 6496 acres. The total available supply during three consecutive dry years was found to be 19,460,000 gallons per day, of which an average of 9,113,472 gallons per day had, and still has, to be sent down the streams as compensation water; leaving 10,346,528 gallons for the supply of the town and district. The reservoirs at Redmires are the oldest; and the middle one of the three was the first constructed. The greatest depth of water in it is 36 feet; and its embankment is 1012 yards in length. As showing how comparatively small were the requirements of Sheffield some half century ago, it may be mentioned that the second reservoir at Redmires—the lowest one of the three—was not constructed till 1847. Its greatest depth is 29 feet; and the length of the embankment, 590 yards. The upper reservoir was completed in 1854. Here the embankment is 780 yards in length. The Engineer (Mr. E. M. Eaton) describes the Redmires dams as types of the old practice of reservoir construction in this country. The predominant features are banks of earthwork, with a puddle wall in the centre, and the absence or insignificance of masonry and brickwork. These and the two dams in the Rivelin Valley, which were made for the supply of compensation water to millowners, were designed and constructed by the late Mr. J. T. Leather, who from 1830 to 1865 was the engineering adviser of the Water Company. Messrs. T. and C. Hawksley subsequently became their advisers; and it is to them and to the enterprise of the late Water Company that Sheffield owes the large reservoirs in the Loxley Valley. The Agden, which was the first of these, has a storeage capacity of 629,000,000 gallons; and its embankment is nearly 100 feet in height. The Strines reservoir, at the head of Bradfield Dale, has a storeage capacity of 513,000,000 gallons, and a drainage area of 2890 acres. That of the Agden is a little more—2999 acres. Immediately below the Strines is the Dale Dyke, which occupies the site of, but is considerably smaller than, the ill-fated reservoir which came to grief on the night of March 11, 1864. The bursting of that reservoir cost the lives of 244 persons, the destruction of much property, and the expenditure of £373,000 in compensation. The new Dale Dyke covers an area of 62 acres, has a depth of 67 feet, a storeage of 486,000,000 gallons, and a drainage area of 1089 acres. The Damflask, situated a little below the Agden, is both the latest, the largest, and the most important of the reservoirs in the Loxley watershed. It is, indeed, nearly as large as the three at Redmires put together. It covers an area of 115½ acres, and has a depth of 85 feet. Its drainage area is 3747 acres; and, when filled, its capacity will be 1158 million gallons. When it can be brought into use, depends entirely upon the progress made with the wing trench.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Are your readers prepared to hear of a new departure in gas making? There have been many since Murdoch first experimented in its manufacture with an old tea-pot; but I question if any have been more momentous for the industry, or better timed, than that which it is my good fortune to communicate to you this week. In the humble gas-works at Peebles, the summer of this year has been devoted to experiments in the enriching of coal gas with gas from mineral oil; and the results obtained are such as will gladden the heart of every gas manager. The value of these experiments will be at once recognized when I state that the author of them is Mr. W. Young, of Priorsford, Peebles, who is the greatest living authority upon the science of destructive distillation. For some time, Mr. Young conducted his operations at the gas-works in Earlston, a small place in Berwickshire; and then, feeling that he had got on the right lines, he transferred his operations to the works of the Peebles Gas Company. He is a Director of this Company, and the works were very wisely placed at his disposal by his co-Directors; and there, in his own neighbourhood, he has been able to carry out his ideas to the full, working with greater comfort than he could have done at a distance from home. He has been ably assisted in his work by the Manager of the works, Mr. A. Bell, jun., to whom the subject is by no means new. It will be remembered, that he read a paper before the North British Association of Gas Managers, at their Dunfermline meeting in 1889, on "The Presence of Sulphur Compounds in Illuminating Mineral Oils." Having established the feasibility of his system by his summer experiments, Mr. Young is now superintending the erection of permanent plant in the works, for the purpose of following out a continued application of it. It may be taken for granted that Mr. Young does not follow the methods adopted by other experimenters in the same line. Those who are familiar with his retort for the extraction of oil from shale (the Young and Beilby), will understand this remark. Like the oil-retort, his gas enriching apparatus is simplicity itself; and when its details are explained, many will wonder that it was never thought of before. But it is the results which your readers will be most interested in; and in speaking of these, I give the words, not of Mr. Young, but of a gentleman whose opinion is unbiassed. According to him, the gas made is of so high an illuminating power that its photometric value can only be determined by mixing it with a poor coal gas, the illuminating power of which is known, and calculating the proportions. Forty-three parts of coal gas of 20·29-candle power mixed with seven parts of oil gas is raised to 30·95 candles; from which it is calculated that the illuminating power of the oil gas is equal to 98 candles, if tested in the standard way, with a No. 7 Bray burner. A higher sperm yield per gallon of oil is got than what is obtained from No. 1 oil with a duplex burner, the calculation for which is 23·24 lbs. of sperm per gallon; and the gas is a permanent one. Almost the only residual product is a very pure carbon, which is extracted at a certain stage, and which amounts to about 2 lbs. per gallon of oil. By Mr. Young's process, the great advantage is obtained that it is possible to use oil which is not specially prepared for gas-making. Such special oil is at present sold at about 8d. per gallon; but he is able to produce the above results with an oil which is put on the market at 3d. per gallon.

The effect of Mr. Young's discovery, if the same results are obtained with the permanent plant as have been with the experimental—and there is no reason for doubt—will be that cannel coal will no longer be required to raise the illuminating power of coal gas, a richer substitute being found, and one at a price which will enable producers of gas to lower their charges. That is the most material element; because if gas of 28 or 30 candle power can be sold for little more than 3s., the process of lowering the quality of gas in progress in Scotland will be at once stopped. The consideration with regard to England is of more consequence, for 16-candle gas will become a thing of the past, and gas of not less than 20 candles will be universal. The discovery will thereby furnish the best weapon for fighting the electric light. One of the greatest features of it, in that respect, is that it is a practical amalgamation of the hitherto rival lights of gas and oil, and ranges them on one side of what may be spoken of as the lighting controversy. And the gain will not be confined to one of the parties to this amalgamation; for, while gas will profit, the oil industry of Scotland, which is just now in a languishing condition, will be once more established as a paying undertaking. I have written strongly upon the subject; but not more so than my authority warrants me, for the description I have received states that "the process appears to be a complete solution of the difficulty hitherto experienced in using heavy or crude mineral oils for gas making." The boon which Mr. Young has conferred upon the gas industry is therefore great. It is not often that it is given to one man to establish an industry, as he, to a large extent, did that of oil manufacture; and then, when it got into a period of decay, to come to its rescue with an outlet through the door of an opponent. It may be stated that in what he has done, Mr. Young has had more in view the bettering of the oil industry than the improvement of gas making; but his interest in the gas industry is not small, and his pleasure at being able to do good to it is greater than if he had merely made a discovery which would have been to the advantage of oil. While Mr. Young is the author of the process, it will be worked by Mr. Bell; and some valuable information on the subject may be expected from him at next summer's meeting of the North British Association, if not sooner.

The Inverness Police Commissioners have reversed the resolution of the Gas and Water Committee to raise the price of gas from 4s. 7d. to 5s. per 1000 cubic feet, which I mentioned last week. This has been done in consequence of the proposal to have a full inquiry made into the administration of the gas undertaking, and of the belief that, if the gas accounts were more vigorously collected, the present price charged would be sufficient to meet the expenditure. At all events, the proposed increase in the price of gas has been delayed until the result of the inquiry be seen—a resolution which is on the lines of common sense. Who is to make the inquiry, is not announced.

Occasionally the ludicrous creeps into the management of a gas

supply. The latest incident of the kind which has come under my notice has taken place at Dumfries, where the Gas Commissioners have rescinded a resolution to lay a new 6-inch main, as being no longer necessary, for the extraordinary reason that it had been found that the existing main had been obstructed by the dead body of a large rat, and that the obstruction being removed, the supply was now satisfactory. It had not been discovered how the rat got into the main. Surely it must have been from the gasholder.

There was another item of business before the Dumfries Gas Commissioners on Monday, which illustrates very aptly the late Poet Laureate's remark that "Science (knowledge) moves but slowly, slowly, creeping on from point to point." But a fortnight ago, your columns contained a communication by Mr. H. Tobey, of Malton, on "Asphalte Paving," in which it was shown that one of the cheapest and best methods of making footpaths was to be found in the use of gas-works products. This knowledge does not seem to have reached Dumfries yet, for, on a letter being submitted from the Clerk to the Police, requiring the Commissioners to repave the footway in front of their property with tiles, and with a granite kerb, they at once agreed to have the work done. I wonder how much cheaper the work could be done, if Mr. Tobey's method were adopted.

Mr. M'Kechnie, the recently appointed Gas Manager at Dunbar, has reported to the Gas Commissioners regarding the economies and improvements which he suggests at the gas-works. He throws the blame for the complained-of bad quality of the gas upon the fittings; and he does not suggest so much alteration at the works as upon these, and the dissemination of information as to how to burn gas to advantage. The cost of all that he recommended to be done at the works was mentioned at about £200. Of course, the expense of altering fittings would fall upon the community. Mr. M'Kechnie reported his willingness, if his suggestions were carried out, to reduce the price of gas from 6s. 4d. to 5s. 10d. per 1000 cubic feet; and he favoured the supplying of gas in the mornings at 4s. 3d. for fuel purposes, in order to encourage increased consumption. The Commissioners did not adopt the latter suggestion; but, taking the bit between their teeth, they bolted from their Manager's proposal, and reduced the price of gas all round to 5s. 5d. per 1000 cubic feet.

The accounts of the Perth Water Commission for the year ending September 30 show a revenue of £5798, of which £5503 was derived from assessments. The expenditure exceeded the revenue by £528. The assets of the Commission amount to £63,010; and liabilities, to £41,606. It is reported that the finances of the Commission are in an exceedingly healthy state, and that its indebtedness is being wiped out faster than was estimated. The rates for the current year were fixed on Monday at 7d. in the pound on houses, 3½d. on shops, and the public rate at 1d. in the pound; the same as last year.

This is the season of the year when public men come before their constituents and give an account of their stewardship for the past year, in soliciting re-election. The Glasgow representatives are this year the most voluble of any in Scotland; and, as a matter of course, gas and water affairs come in for a large share of attention. It would be impossible to take notice of all that is being said. One general remark is, however, being made, to the effect that, though the past year resulted in a loss of about £20,000 on the Corporation gas undertaking, it is expected that this year will work out better, and that a reduction in the price of gas will be effected next year. Mr. Murdoch, a member of the Gas Commission, finds consolation in the fact that, considering the steadily increasing demand for gas, and the consequent necessity for increasing the manufacturing power, the electric lighting installation, which is expected to be in operation very shortly, will have the effect of temporarily reducing the demand for gas until the new works are finished. Major Cassells gave the electors in the 21st Ward the information that the value of the gas-works was £1,030,000; and that, had he to erect works equal in efficiency, he would not undertake to do so for twice the amount. Also that they employed 3200 men in the gas-works, and had 2600 retorts going, which would be increased to 3600 when the extension at Dawsholm is completed. An elector's view of the management of gas-works was given at a meeting of the 22nd Ward, by a Mr. Peter Hutcheson; and as it is so extraordinary, I think it worth quoting. Speaking of the recent increase of 3d. per 1000 cubic feet in the price of gas, he said that "two years ago a question was raised about a strike; and the Gas Commission submitted, instead of fighting the men, who were working two hours a day and sitting idle nine, and who were getting 5s. These men were allowed to alter their time from this nominal twelve hours—they were at work ten minutes every hour—to eight hours a day, which was a working day of one hour and twenty minutes at 5s., for unskilled labour. He wanted to know whether their representatives would look into the extravagant cost of making gas, and seek to remedy it in future." One of the representatives was silly enough to say he would do so; but what will some men not do when they are seeking re-election? Comment on Mr. Hutcheson's remarks is unnecessary; but they show how much ignorance exists in the minds of the community as to what goes on in gas-works. The references to the water question I must hold over till next week.

When attending the meetings of the North British Association of Gas Managers at Stirling last July, I was struck by the extremely ready and appropriate utterances of the President, Mr. A. MacPherson, of Kirkcaldy. The secret is out. He is Speaker of the Kirkcaldy Parliamentary Debating Society. Why he is not Member of Parliament for the Kirkcaldy Burghs, I cannot say. It is well known that, when a vacancy in the representation occurred last winter, there was some difficulty, not in procuring a candidate, but in selecting one; and, without detracting in the least from the merits of the journalist who was elected, I make bold to say that Mr. MacPherson would have filled the office as well as he does. Mr. MacPherson's duties, however, lie nearer home than at Westminster; and I have no doubt that his services in the burgh are of more value to the community than if he were their representative in Parliament. It is a pleasant task, however, to record that his services as Speaker of the smaller Parliament are as much appreciated as are those which he renders so efficiently to the town in the capacity of Gas Manager. On Monday night, at the opening meeting of the Society for the winter, the members took advantage of the occasion to present him with a handsome silver salver, as a marriage gift, and to mark their appreciation of his services to the Society. Both sides of the "House," as is done at Westminster, united in testifying to their high opinion of "the Speaker;" and there was a happy bit of chaff in the remarks of the leader of the "House" in that, though they could claim the Speaker as a Home Ruler, the other side could claim him as a practical Unionist. I have not the slightest doubt that, under Mr. MacPherson's guiding hand, the Kirkcaldy Parliamentary Society is a place where both pleasure and profit can be obtained.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Oct.* 15.

Sulphate of Ammonia.—The market has become somewhat irregular; but this is due to the random quotations of the dealers rather than symptoms of weakness on the part of producers. Stocks continue at a low ebb; on the other hand, buyers seem determined to bide their own time at present. Many of the foreign consumers can afford to wait awhile, having sulphate to receive on cheap contracts made some time ago. Deliveries, however, are but slowly made to them, because their contractors on this side are at present losing money on these sales. The latter condition is sufficient to account for the desperate efforts made to depress the market, although with insignificant results so far, in consequence of the latent firmness of the position. Sulphate is still quoted at £10 2s. 6d., with the exception of Leith, where there are sellers at £10. Nitrate is much stronger in tone; and a slight advance has taken place. It is stated that, if the shipments should remain within the restricted maximum, the available supply for the spring of 1893 would be 130,000 tons less than this year; and the stocks in Europe at the end of April last were only 85,000 tons.

LONDON, *Oct.* 15.

Tar Products.—The market is inactive. Very little business is being done; both buyers and sellers holding aloof—one expecting lower prices, and the other material advances. Creosote is in better request; and more business is reported in it. But, as stocks are large, it is not likely that higher prices will be easily obtained. Carbolic acid is again better; the large stocks of this article, both in the crude and finished states, which have so long depressed the market have disappeared. It it expected that when the requirements for ordinary uses have to be filled up, there will be a short supply, and consequently a higher price. Pitch stocks are low; and shipments of this article are being largely made. To-day's values may be taken as: Tar, 10s. Pitch, 27s. 6d. Benzol, 90's, 1s. 7½d.; 50's, 1s. 4d. Toluol, 1s. 2d. Solvent naphtha, 1s. 1½d. Crude benzol naphtha, 30 per cent., 7¼d. Creosote, 1⅜d. Creosote salts, 20s. Pressed naphthalene, 45s. Carbolic acid, 60's, 1s. 2½d.; 70's, 1s. 6d.; crystals, 5½d. Cresol, 10½d. Anthracene, 30 per cent., "A" quality, 9d.; "B" quality, 7d.

Sulphate of Ammonia.—This market is not quite so firm; and business is reported at from £10 to £10 2s. 6d., less 3½ per cent. Considerable quantities have changed hands; but the only buyers at the moment appear to be speculators, who are probably covering forward sales. Stocks in all quarters continue low; and if makers would only exercise common discretion, higher prices could be obtained. Gas liquor (10-oz.), 6s. to 7s. per ton.

COAL TRADE REPORTS.

Lancashire Coal Trade.—The better qualities of round coal are meeting with a steadily increasing demand, which is keeping collieries generally working five days per week, with a few pits running full time. There is, however, still no pressure of orders; and in some cases small quantities are going down into stock. Although there is no actually upward movement in prices, they are all hardening up to full list rates; and in some instances, where actually announced reductions were made during the summer months, circulars are being sent out intimating advances of about 6d. per ton. Current prices quoted of late remain practically unchanged. Best Wigan Arley at the pit mouth still ranges from 12s. to 12s. 6d.; Pemberton four-feet, and second qualities of Arley, 10s. 6d. to 11s.; and common house-fire coals, 8s. 6d. to 9s. per ton. But the maximum figures are becoming more nearly the general quotations. Other descriptions of fuel remain without any improvement. Requirements for steam and forge purposes continue very indifferent; and the gradually slackening activity in the principal coal-using industries of Lancashire affords no hopeful prospect for the future. At the pit mouth, ordinary descriptions of steam and forge coals do not average more than 7s. 6d. per ton; and where large quantities have to be dealt with, prices are irregular. The better descriptions of engine fuel move off fairly well, but are plentiful; and common sorts are rather a drug, with cheap supplies coming in from outside districts. So far, Lancashire coalowners have not materially altered their price. Burgy still averages 6s. to 6s. 3d.; best slack, 5s. to 5s. 3d.; medium, 4s. to 4s. 3d.; and common, 3s. 3d. to 3s. 6d. per ton—a want of firmness being already noticeable in many cases. The demand for steam coal for shipping continues very quiet at about 8s. 6d. per ton, delivered at the ports on the Mersey. The Manchester and Salford gas-works have recently been getting pretty high figures for their coke—prices at Salford having been put up to 15s., and in Manchester to 12s. 6d. per ton. These rates, have, however, not been long maintained; and during the past week, the Salford Corporation have dropped to 12s. 6d., and Manchester to 8s. 4d. per ton.

Northern Coal Trade.—The coal trade is decidedly weaker in the last few days, especially in the steam coal branches. Best Northumbrian steam coal is now quoted 9s. 6d. per ton f.o.b.; and it is believed that some slight discount is allowed from that price in certain cases, in order to obtain fuller work. Second-class and small steam are also weak, and are proportionately lower in price. Bunker coal has been sold at 6s. 10½d. per ton; but for the best Durham qualities rather more is asked—from 7s. per ton for unscreened qualities, up to 9s. 6d. per ton for best screened. For gas coal there has been a considerable addition to the demand; but the production has responded thereto, and the price is little, if any, higher. For best Durham gas

coals, 7s. 6d. per ton has been accepted by some collieries. But there are others who ask from that up to 8s. 6d. per ton; and one or two of the largest producers are so freely committed ahead that they decline to quote prices just now. Manufacturing coal is dull; and new contracts are invariably at some reduction in prices, for the demand is much reduced by the dulness in the shipbuilding industry. Nut coals are also in rather lower demand for export. On the other hand, the coke trade is very steady. There is a falling off in the demand for export; but the local consumption is very large. The price is about 13s. 6d. per ton at the blast-furnaces; and from 15s. to 16s. per ton f.o.b. for export. Gas coke shows no alteration this week.

Scotch Coal Trade.—There is still quietness in the coal trade in Scotland. The reduction of 6d. per day in the West has been accepted; but the men, by limiting their time to four days a week, are doing all they possibly can to check the output. Even with this restriction of time, the supplies are equal to the requirements; and whatever may be the ultimate result upon the wages of the men, the limitation has not as yet affected prices. Unless the iron trade should experience a spurt, of which there is no indication, the outlook is not very encouraging for either the miner or the coalmaster. Shipments still continue large; but, as frequently stated, the traffic is chiefly in the working off of old contracts. During the past week, the shipments amounted to 169,930 tons—an increase of 1649 tons upon the preceding six days, and of 17,848 tons upon the corresponding week of last year. For the year to date, the total shipments have been 5,889,258 tons—an increase over the same period of last year of 701,058 tons. The prices quoted are: Main, 6s. 10d. to 7s.; ell, 8s. to 8s. 3d.; splint, 7s. 6d. to 7s. 9d.; and steam, 9s. 6d. to 9s. 9d. per ton. It is reported that, since the Glasgow Corporation made their purchases for the remainder of the year, there is a perceptible slackening in the demand for gas coal. Cannel is accumulating; and even second-class varieties are getting more plentiful, the only demand which can be said to be brisk being for third and fourth classes.

Heytesbury Water Company, Limited.—A Company under this title has been registered with a capital of £4000, in £1 shares, to supply water to Heytesbury and the surrounding district. Of the total number of shares, 3994 are held by Lord Heytesbury.

Reduction in the Price of Gas at Pontypool.—The Directors of the Pontypool Gas Company have reduced the price of gas from 4s. 3d. to 4s. per 1000 cubic feet, commencing with the present month, subject to the accounts being paid within a month of the end of each quarter.

The Water Supply of Gildersome by the Morley Corporation.—The Morley Corporation have received a communication from the Local Government Board sanctioning the application of the Corporation to supply the township of Gildersome with water. The application was the subject of an inquiry a short time ago (see *ante*, p. 311).

Increase in Salaries in the Nelson Gas Department.—The minutes of the Gas Committee submitted at the last meeting of the Nelson Town Council recorded a resolution advancing the salary of the Assistant Gas Manager. Their confirmation having been moved, Mr. Tattersall said he found that during the last six months an additional £400 had been spent in wages in the Gas Department; and Alderman Hartley explained that the cause of the increase in salaries was on account of the development of the work. The electric lighting scheme would shortly be commenced, and would be particularly the work of the Assistant Gas Manager; and there was no doubt his services would be well worth the increased salary. The minutes were confirmed.

Resignation of the Vice-Chairman of the Bolton Water Committee.—Mr. T. W. Holden has resigned the position of Vice-Chairman of the Bolton Water Committee, in consequence of the action of that body respecting the pollution of the Heaton reservoir. It is alleged that sewage from the neighbourhood may, under existing conditions, contaminate the water in the reservoir; and the Committee recently decided to contribute a sum not exceeding one-third of the cost, nor more than £250, towards the construction of a sewer to prevent this. Mr. Holden, who has been Acting Chairman of the Committee in the absence of Mr. Alderman Glaister, protests against the expenditure of money on sewage works outside the borough, and marks his disapproval by resigning. The Committee have asked him to reconsider his decision.

The Price of Gas at Preston.—On Monday evening last week a largely-attended public meeting, convened by the Mayor (Mr. Humber), was held at Preston, to protest against the proposal of the Gas Company to increase the price of gas by 4d. per 1000 cubic feet. Alderman Walmsley moved—"That this meeting protests against the action of the Gas Company in raising the price of gas, condemns their past extravagant expenditure of capital, and hopes that, as soon as practicable, the Corporation will consider the question of further utilizing the electric light; that under any circumstances this meeting trusts that no further charge will be made for meters; and that the Mayor be requested to forward a copy of this resolution to the Company." In support of the resolution, he said the average net price of gas in about 40 towns, most of which were smaller than Preston, was 2s. 6d. per 1000 feet; while the lowest price ever charged in Preston was 2s. 9d. The average expenditure on capital account per million cubic feet of gas in these 40 towns was £651; in Preston, it was £962. The income of the Company for the past year was £78,712, and the expenditure £60,800—leaving a profit of £17,900; and to pay the dividends of 10 per cent. on the "A" stock and 7 per cent. on the "B" stock, they nibbled £6000 from the reserve fund. For the last forty years at least, the Company had had every shilling they could lay hands on; they had had the absolute maximum dividend they were allowed to have every year. The Chairman of the Gas Company made the lame, the idle excuse that the rise in the price of gas was owing to the increased rates and taxes, the higher price of coal, and the decrease in the receipts for residuals—the facts being that the increase in the rates and taxes was fractional only on the gas consumed, and in the price of coal there had been an actual reduction. It was true that the value of residuals had decreased a little. Mr. T. H. Myres seconded the motion, and it was carried.

A Westmoreland Water Scheme.—It was reported, at the meeting of the Kirkby Stephen Rural Sanitary Authority yesterday week, that contracts had just been let for the construction of water-works for a group of villages in the Eden Valley, amounting to about £2000.

Electric Lighting for Wolverhampton.—The Wolverhampton Town Council yesterday week determined to purchase a piece of land, containing about 2846 square yards, on which to erect an electric light station, for £1900, *plus* vendor's costs. Among the circumstances that influenced the Lighting Committee in choosing this site was the possibility of adjoining land now belonging to the Corporation being utilized for the erection of a destructor and a stone-breaking machine, in which event the heat generated by the destructor might be employed in the production of electrical energy.

New Water-Works for Norton (Malton).—The Norton Board of Health have borrowed £3000, at 3⅛ per cent. interest, for the purpose of carrying out an entirely new scheme of water supply. At present the town takes its supply from Malton; but the Board are not satisfied with the arrangements nor the price charged. The Engineers of the new scheme are Messrs. Fairbank, of Driffield and Westminster; and it is to be in full operation by March 25 next. The source of the new supply is a spring about three-quarters of a mile from the town; and the water will be pumped by a 6-horse gas-engine.

The Wenham Company, Limited.—We have received a copy of the new price-list which has been prepared by the above Company for the coming season; and the attention of those who are contemplating the introduction or extension of high-power gas-lamps may be profitably directed thereto. On a well-executed coloured lithographed plate are shown some of the best types of lamps; but full particulars of all the forms made by the Company, as well as of their floor-warming stoves, louvre ventilators, &c., are given in their list. The various patterns of the last-named appliances are also set out in a neatly-printed pamphlet.

A "Moral" Obligation.—For some time past the Oswaldtwistle Local Board have been endeavouring to induce the Blackburn Corporation to supply water to the district of Belthorn, an outlying portion of the Local Board's district. The Corporation have declined to accept responsibility; and now the Local Board are appealing to the Lancashire County Council in the matter, on the ground that the Corporation are morally, if not legally, bound to supply the district, because they have appropriated the gathering-ground at Belthorn, and diverted the natural water supply of the district. It will be interesting to have the result of this appeal to the "moral" obligation of a Corporation.

The Proposed Purchase of the Barry and Cadoxton Gas and Water Works by the Local Board.—A largely-attended meeting of the property-owners and ratepayers of the Barry and Cadoxton district was held last Friday week, to consider the desirability of passing a resolution authorizing the Local Board to promote a Bill in the next session of Parliament to acquire the gas and water undertakings. The Chairman of the Board (Mr. J. Robinson, M.Inst.C.E.), having delivered an address explanatory of the object of the meeting, Mr. Alexander, as President of the local Chamber of Trade, submitted a resolution in favour of the purchase passed by the Council at a general meeting held the previous evening. Addresses both for and against the resolution were then delivered; some of the speakers making strong comments on the alleged unwholesome character of the water and the inferior quality of the gas supplied by the Company. The resolution was carried by an overwhelming majority.

The Proposed Extension of the Goole Gas and Water Works.—A statement was recently published in the JOURNAL to the effect that the Goole Gas and Water Company intend making a call of £20,000, in order to place their gas and water supply in a good condition. We learn that the scheme has undergone considerable development; and the amount of money required will be £37,000, of which sum £20,000 will be devoted to the improvement of the gas plant, and £17,000 to the water-works. In connection with the latter, boring operations have already been commenced at Beaver's Bridge, near the Goole and Knottingley Canal. Should a sufficient and wholesome supply of water be found, the Aire and Calder Navigation are willing to dispose of a plot of ground to the Company. In regard to the gas-works, it is thought inexpedient to extend the present premises; and with a view to a plentiful and pure supply of gas being obtained, additional works are to be erected at Rawcliffe Bridge, near the water pumping station—negotiations having been already opened for the purchase of 4 acres of land. It is proposed to promote a Bill in the ensuing session of Parliament for additional borrowing powers to the extent of £50,000.

Gas Affairs at Longton.—A Sub-Committee of the Longton Town Council appointed to consider the question of deposits, discounts, and the best means of encouraging the consumption of gas among small consumers, have made the following recommendations: (1) "That the automatic prepayment meter be adopted as a means of encouraging the consumption of gas among small consumers." (2) "That, in view of the charge for meter-rents having been recently abolished, which is a concession to the consumers, and may be considered as equivalent to a reduction in, or a discount off the price of gas, your Sub-Committee is of opinion that any further discount would be unadvisable at the present time." (3) "With reference to the system of requiring deposits from consumers as security for the payment of gas-rent, your Committee is of opinion that it is not desirable to abolish this system, but rather that the principle be extended, and recommends that in future, where the automatic prepayment meter is not used, a deposit be required from all new consumers." There was very little discussion on the subject when it came before the Council at their last meeting; two or three members merely expressing the opinion that the proposal as to deposits would rather tend to hinder than encourage the consumption of gas. Eventually, however, the recommendations were adopted. On the same occasion, the Town Clerk reported that the steam-roller belonging to the County Council had damaged a number of gas-mains belonging to the Corporation; and as the Council refused to pay the damage, he had received instructions to take proceedings.

Serious Gas Explosion at Wakefield.—About eight o'clock last Saturday morning, a disastrous explosion took place at the Crown Hotel, Wakefield. Owing to the floods resulting from incessant rain, the cellar of the hotel, like those of all the houses in the neighbourhood, was filled with water, the force of which displaced the gas-meter and disconnected the service-pipe. In order to get to the meter, a hole was being bored in the smoking-room floor, when an explosion occurred, caused by the gas reaching the fireplace. The landlord and his wife (Mr. and Mrs. Steele) and a customer were precipitated among the *débris* into the flooded cellar below, but they were rescued without sustaining serious injuries. In all seven persons were hurt, and the interior of one end of the hotel was completely wrecked—nearly every window being blown out.

Sheffield Corporation Water Bill.—A special meeting of the Sheffield Town Council was held last Wednesday for the purpose of approving and authorizing the promotion of a Bill to amend the provisions of the Corporation Water Acts relating to the water-rents, to extend the time limited by the Act of 1881 for the completion of certain reservoirs, and for other purposes. The necessary resolution was moved by Alderman Gainsford, who said the simple position was that the Water Committee were well able to do either of two things—viz., to bear the reduction of 25 per cent. in the water-rents if they had not the sinking fund also to bear, or to keep up the sinking fund entirely if they had not to face the reduction of 25 per cent. in 1894. The deficiency of ability to do both these things was calculated to be £152,000 out of £2,300,000, the total cost of the undertaking. In the course of years, the whole of the £2,300,000 would be provided for out of the concern itself, with the exception of this £152,000; and the object of the Bill was to enable the Corporation to retain so much of the 25 per cent. as would give them this £152,000. The only other remark he would make was that this was the greatest justification of the action which the Corporation took in 1887 in resisting the application of the Water Company for a permanent imposition of the 25 per cent. It was now seen that nothing of the kind could be required. Sir Henry Stephenson seconded the resolution, which was adopted.

The Sewer-Gas Destructors at Richmond (Surrey).—The Richmond Gas Company having given final notice to the Richmond Town Council that the supply of gas to the sewer-gas destructors in use in the town would be discontinued at the end of last month, a Committee was appointed to confer with the Directors of the Company on the question, and on the 1st inst. several members of the Committee (of which Mr. Dimbleby is Chairman) waited upon the Directors by appointment. All the members of the Board were present; and with them Mr. Thomas May, the Engineer, and Mr. Corbet Woodall, their Consulting Engineer. In explaining to the deputation the nature of the risk the Company feared existed, these two gentlemen agreed in making a suggestion which they considered would overcome the difficulty. This was that two sheets of wire gauze should be placed between the sewer and the gas-flame, on the principle of the Davy safety lamp. This, it was pointed out, would effectually prevent the flame passing into the sewer, and therefore there could be no risk of explosion in case coal gas should by some accident have found its way into the sewer. Mr. Dimbleby addressed the Directors with a view to securing an extension of time until the 1st of January next; and he promised that the Town Council would in the meanwhile do their utmost to arrive as speedily as possible at a decision with regard to the destructors—either to amend them as suggested, or do away with them altogether. After some discussion, the Directors agreed to extend the time as requested, on the terms mentioned. On the following Monday the Committee of the Town Council met, when Mr. S. Holman, the patentee of the destructors, was present, and the question was thoroughly discussed. He submitted a plan showing a modification of the suggestion made on behalf of the Company, which he thought would meet their views. He agreed to experiment with the gauze,, in conjunction with the Borough Surveyor and the Company's Engineers.

The Lambeth Water Company and their Charge for Baths.—A conference between a Special Water Committee of the Camberwell Vestry and the ratepayers of that parish who are consumers of water supplied by the Lambeth Company was held last Wednesday, at the Vestry Hall, Peckham Road. Mr. Seth Coward (Chairman of the Committee) presided. In opening the proceedings, he referred to the manner in which the Company had obtained parliamentary sanction for their special charges. It was, he said, on the distinct understanding that they would not be enforced except in extreme cases; and now the maximum charge was levied in nearly every case. Mr. Teesdale moved—"That this conference is of opinion that the words of the Lambeth Water Act, 1848, do not authorize the Company to demand any extra payment for a bath in a private dwelling-house." In the course of the subsequent discussion, attention was called to the decision in the well-known case of the *Sheffield Water Company v. Bingham*, where it was held that the words of the Act covered a bath in a private house. Mr. Archibald Dobbs said he had heard a good deal about the case upon which the Company relied; but the language of the two Acts was not identical, as had been contended. Mr. Gibbon moved, as an amendment—"That the action of the Company in demanding extra payment for baths is illegal, and unauthorized by the Act of 1848." On a vote being taken, the amendment was lost, and the original motion carried with one dissentient. The Chairman then moved—"That, inasmuch as the Lambeth Water Company's Act, even if it contemplates any payment for a bath in a private dwelling-house, provides no scale of charges, this conference requests the Camberwell Vestry, as representing the ratepayers of the parish, to ask the Lambeth Water Company to substitute for its present charge of 10s. per annum for each bath, the scale of charges specified by Parliament in the Southwark and Vauxhall Water Company's Act of 1852—viz., where the annual value is less than £30, no extra charge; where it exceeds £30, according to the rates or charges limited for fixed baths by section 53 of that Act. This proposal to be without prejudice." To this an amendment was moved to the effect that the Vestry should be asked to take such immediate steps as they might deem advisable to prevent the Company making the charge in future. A long discussion ensued; and eventually the resolution was withdrawn, and the amendment was carried.

Reduction in the Price of Gas at Portobello.—The Directors of the Portobello Gas Company have reduced the price of gas from 4s. 9d. to 4s. 4d. per 1000 cubic feet.

Georgetown (British Guiana) Gas Company, Limited.—In their report on the working of this Company for the half year ending June 30 last, which will be presented to the shareholders at their ordinary general meeting on the 1st prox., the Directors state that the profit amounts to £1146, which is an increase of about £35 upon that of the preceding six months. As mentioned in the last report, the public lighting of a considerable portion of Georgetown has been given over to an electric lighting company. Consequently, there has been a falling off in the revenue under this head; but that for private lighting shows an increase as compared with the previous period, and there is the additional profit referred to above. The Directors recommend the declaration of a dividend for the past half year at the rate of 8 per cent. per annum on the preference capital, and of 6 per cent. per annum on the ordinary capital, both less income-tax (except upon those dividends payable to the local shareholders). The Engineer (Mr. T. B. Younger) reports the works in good order.

The Water Supply of Bradford Out-Townships.—An agreement has been drawn up between the Bradford Corporation and the Local Boards of Pudsey, Calverley, and Farsley, whereby the Corporation agreed to supply the three Boards with water in bulk for distribution in their respective townships. At the last moment, however, differences arose over a demand by the Corporation that the Boards should bind their respective townships to take the water in perpetuity. This they resolutely refused to do; and a rupture was threatened. A few days ago a deputation waited on the Corporation, and informed them that, if they persisted in this demand, it would end in the breaking off of negotiations, for the Boards unanimously refused to consent. The Corporation then offered to substitute for it a twenty-one years' agreement; but the deputation refused this, and suggested ten years, but finally decided to accept fifteen. This did not meet with the approval of the Corporation. The Boards have since fully considered the matter; and at a private meeting of the Pudsey Board, held last Monday week, the action of the Joint Committee, offering an agreement for fifteen years, was approved.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 676.)

Issue.	Share	When ex-Dividend.	Dividend & Div. & Bonus.	NAME	Paid per Share	Closing Prices	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	14 Oct.	10½	Alliance & Dublin 10 p. c.	10	15¼–16¼*	..	6 7 3
100,000	10	,,	7½	Do. 7 p.c	10	10½–11½*	..	6 10 5
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	105—107	..	4 13 4
100,000	20	27 May	8	Bahia, Limited	20	10—12	..	13 6 8
200,000	5	12 May	7½	Bombay, Limited	5	6—6½	..	5 15 9
40,000	5	,,	7½	Do. New	4	4—4½	..	6 13 4
380,000	Stck.	12 Aug.	12½	Brentford Consolidated	100	212—217	..	5 10 7
150,000	,,	,,	9½	Do. New	100	163—168	..	5 10 1
220,000	20	15 Sept.	11½	Brighton & Hove Original	20	40—42	..	5 9 6
888,500	Stck.	31 Aug.	5	Bristol	100	102—107	+7	4 13 5
320,000	20	29 Sept	11½	British	20	42—44	+1	5 2 3
50,000	10	31 Aug.	11½	Bromley, Ordinary 10 p. c.	10	19—20	..	5 15 0
51,510	10	,,	8½	Do. 7 p. c.	10	14½–15½	..	5 9 8
328,750	10	—	—	Buenos Ayres (New) Limited	10	7–8	+1	—
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	94–98	+2½	6 2 6
150,000	20	12 Aug.	8	Cagliari, Limited	20	25—27	..	5 18 6
550,000	Stck.	14 Oct.	13	Commercial, Old Stock	100	231–236*	+½	5 10 2
165,000	,,	,,	10	Do. New do.	100	179–184*	+1	5 8 8
160,762	,,	15 June	4½	Do. 4½ p. c. Deb. do.	100	123—128	..	3 10 4
800,000	Stck	15 June	10	Continental Union, Limited	100	227—232	+2	4 6 2
200,000	,,	,,	7	Do. 7 p. c. Pref	100	190—195	..	5 2 7
75,000	Stck.	15 Sept.	10	Crystal Palace District	100	185—190	..	5 5 3
486,090	10	28 July	10	European, Limited	10	20—21	+½	4 15 3
354,060	10	,,	10	Do. Partly paid	7½	14—15	..	5 0 0
5,470,820	Stck.	12 Aug.	12	Gaslight & Coke, A, Ordinary	100	215—220	..	5 9 1
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	95—98	..	4 1 7
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	257—262	..	3 16 3
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	116—121	..	4 2 7
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	166—171	..	4 7 8
1,300,000	,,	,,	7	Do. H, 7 p. c. max	100	162—167	..	4 3 10
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	255—260	..	3 16 11
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	150—154	..	3 17 11
1,061,150	,,	15 June	4	Do. 4 p. c. Deb. Stk.	100	118—121	..	3 6 1
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	123—127	..	3 10 10
908,000	,,	,,	6	Do. 6 p. c. do	100	164—169	..	3 11 0
3,800,000	Stck.	12 May	12	Imperial Continental	100	228—231	+½	5 3 10
75,000	5	15 June	6	Malta & Mediterranean, Ltd.	5	4–4½	..	6 13 4
560,000	100	1 Oct.	5	Met. of Melbourne, 5p. c. Deb.	100	106—108	..	4 12 7
541,920	20	15 June	5	Monte Video, Limited	20	14—15	+1½	6 13 4
150,000	5	27 May	10	Oriental, Limited	5	8½–8¾	..	5 14 3
60,000	5	29 Sept.	7	Ottoman, Limited	5	4—5	..	7 0 0
166,870	10	—	2	Pará Limited	10	2–3	+½	—
				People's Gas of Chicago—				
420,000	100	3 May	6	1st Mtg. Bds.	100	106—110	..	5 9 1
500,000	100	1 June	6	2nd Do.	100	100—10	..	5 16 7
150,000	10	—	10	San Paulo, Limited	10	9—10	+½	—
500,000	Stck.	31 Aug.	15½	South Metropolitan, A Stock	100	275—285	..	5 8 9
1,350,000	,,	,,	12	Do. B do.	100	230—235	+1	5 2 1
230,000	,,	,,	13	Do. C do.	100	240—245	..	5 6 1
725,000	,,	14 July	5	Do. 5 p. c. Deb. Stk.	100	140—144	..	3 9 6
60,000	Stck.	31 Aug.	11½	Tottenham & Edm'nton, "A"	100	225–230	..	5 0 0
				WATER COMPANIES.				
743,952	Stck.	1 July	10	Chelsea, Ordinary	100	245—250	..	4 0 0
1,720,252	Stck.	14 Oct.	8	East London, Ordinary	100	197–202*	+4	3 19 2
544,440	,,	1 July	4½	Do. 4½ p. c. Deb. Stk.	100	140—144	..	3 2 6
700,000	50	1 July	8½	Grand Junction	50	99—103	..	3 17 8
708,000	Stck.	12 Aug.	11	Kent	100	262—267	..	4 2 5
1,043,800	100	1 July	9½	Lambeth, 10 p. c. max.	100	215—220	..	4 6 4
406,200	100	,,	7½	Do. 7½ p. c. max.	100	190—194	..	3 17 3
279,700	Stck.	29 Sept.	4	Do. 4 p. c. Deb. Stk.	100	122—125	..	3 4 0
500,000	100	12 Aug.	12½	New River, New Shares	100	320—330	..	3 23 6
1,000,000	Stck.	28 July	4	Do. 4 p. c. Deb. Stk	100	128—132	..	3 0 7
902,300	Stck.	15 June	6½	S'thwk & V'xhall, 10 p. c. max.	100	147—150	..	4 6 8
126,500	100	,,	6½	Do. D 7½ p. c. do.	100	134—138	..	4 14 3
1,155,066	Stck.	15 June	10	West Middlesex	100	240—245	..	4 1 7
						*Ex div.		

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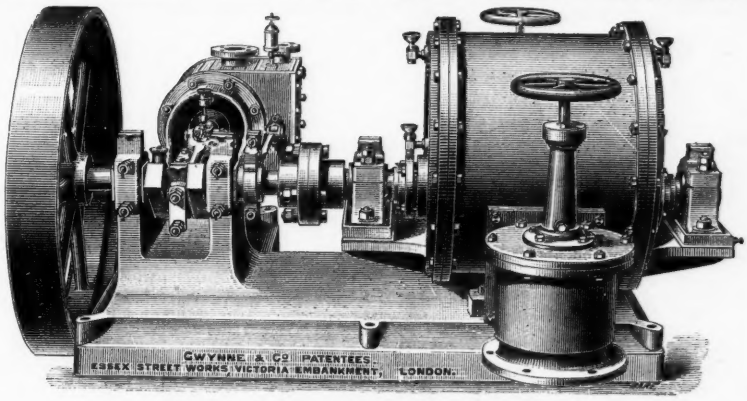

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Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

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Applications, in candidate's own handwriting, stating age, whether married or single, and full particulars as to experience, and enclosing testimonials (copies only), not exceeding three in number, to be addressed to Mr. W. R. Herring, Engineer, Gas-Works, Huddersfield, on or before Thursday, the 3rd of November, endorsed "Draughtsman."
Canvassing of members of the Council will be a disqualification.

H. BARBER,
Huddersfield, Oct. 14, 1892. Town Clerk.

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Apply, in first instance, by letter, to No. 2151, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

BOROUGH OF NELSON.
(GAS DEPARTMENT.)

THE Gas Committee of the above Cor- poration invite TENDERS for the construction and erection of a FOUR-LIFT GASHOLDER, 150 feet diameter, at their Brierfield Works.
Plans and Specifications can be seen at the Office of the Engineer, Mr. W. Foster, Gas-Works, Nelson.
Form of Tender may be obtained from the Engineer on deposit of Three Guineas, which will be returned on receipt of a *bonâ fide* tender.
Sealed tenders, endorsed "Gasholder," and addressed to Mr. R. M. Prescott, Town Hall, Nelson, to be sent in on or before Saturday, the 22nd day of October, 1892.
The Committee do not bind themselves to accept the lowest or any tender.

By order
R. M. PRESCOTT
Town Clerk.

Town Hall, Nelson,
Sept. 30, 1892.

FIRE-CLAY GOODS.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the supply of FIRE-CLAY GOODS (Retorts, Bricks, &c.) required for repairs at their Neepsend and Effingham Street Stations, during the next Twelve Months.
Specifications and Forms of Tender may be had on application to the Company's Engineer, Mr. Fletcher W. Stevenson.
The Directors do not bind themselves to accept the lowest or any tender.
Sealed tenders, marked "Tender for Fire-Clay Goods," must be delivered by post, addressed to the undersigned, not later than Saturday, Nov. 5 next.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
Oct. 12, 1892.

TO IRON ROOF MANUFACTURERS, ETC.

THE Directors of the Sheffield United Gaslight Company invite TENDERS for the construction of an IRON ROOF, 246 feet long by 60 feet wide, with Columns and Girders to carry the same, to cover a portion of their Coal Sidings.
Forms of Tender with Bill of Quantities may be obtained, and the Drawings may be seen, upon application to the Engineer, Mr. Fletcher W. Stevenson, at the Company's Offices, Commercial Street.
The Directors do not bind themselves to accept the lowest or any tender.
Sealed tenders, marked "Tender for Iron Roof," and addressed to the undersigned, must be delivered at the Company's Offices by post not later than Monday, the 7th day of November next.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
Oct. 12, 1892.

TO TAR DISTILLERS AND OTHERS.

THE Directors of the Brentwood Gas and Coke Company invite TENDERS for their surplus TAR, at per Gallon, for One year, commencing Nov. 1 next.
The Tar will be pumped into Casks on the Company's Premises, such Casks to be found by the Contractor.
The Directors do not bind themselves to accept the highest or any tender.
Tenders to be sent in on or before Monday, Oct. 31, addressed to the Chairman of the Company.

By order,
C. A. FIELDER,
Secretary.

Brentwood, Essex.

GREAT WIGSTON GAS COMPANY.

TAR CONTRACT.

THE Directors of the above Company invite TENDERS for the surplus TAR for One Year, ending Sept. 30, 1893. Probable quantity, 80 to 100 tons, delivered into tanks on the M. R. Company's Siding, or into Boats on the Old Union Canal, Kilby Bridge.
Payments, Monthly.
The Directors reserve to themselves the right of accepting any tender.
Tenders for Tar to be addressed to me not later than the 31st of October.

JOHN A. HARRIS,
Engineer and Manager.

COUNTY BOROUGH OF STOCKPORT.
(GAS DEPARTMENT.)

TENDERS FOR RETORT MOUTHPIECES.

THE Gas Committee invite Tenders for the supply of 128 MOUTHPIECES ⊏-shaped, 23 in. by 17 in., with Patent Lids, for their Portwood Works.
Further particulars may be obtained from the Engineer, Mr. S. Meunier, Stockport.
Tenders, endorsed "Tender for Mouthpieces," and addressed to the Chairman of the Gas Committee, Stockport, must be sent in on or before the 27th of October, 1892.
The resolution of the Council that Contractors will be expected to pay the average rate of Wages paid in the district will apply to this contract.
The Committee do not bind themselves to accept the lowest or any tender.

By order,
WALTER HYDE,
Town Clerk.

Stockport, Oct. 15, 1892.

RE SUTTON COLDFIELD GASLIGHT AND COKE COMPANY, LIMITED, IN LIQUIDATION.

MESSRS. LYTHALL and WALTERS are instructed by the Liquidator to SELL by AUCTION (unreservedly), on Tuesday, Nov. 1, 1892, the whole of the WORKING PLANT, capable of producing 240,000 cubic feet of Gas per day.
Sale at Two o'clock.
Also, the same day, at 6.30, the FREEHOLD LAND, with HOUSE and extensive BRICK BUILDINGS thereon.
Full particulars from the AUCTIONEERS, Bingley Hall, BIRMINGHAM; and SUTTON COLDFIELD.

GEORGETOWN (BRITISH GUIANA) GAS COMPANY, LIMITED.

NOTICE is hereby given, that the ORDINARY HALF-YEARLY GENERAL MEETING of the Shareholders of the above Company will be held at the Offices of the Company, 30, Gracechurch Street, in the City of London, on Tuesday, the 1st day of November next, at Three o'clock in the Afternoon precisely, to receive the Directors' Report and the Accounts of the Company for the Half Year ended the 30th day of June last, to declare a Dividend, and to transact the General Business of the Company.
The Transfer Books will be closed from the 19th of October to the 1st of November next, both inclusive

By order of the Board,
SAMUEL WOOD,
Secretary.

Offices: 30, Gracechurch Street,
London, Oct. 4, 1892.

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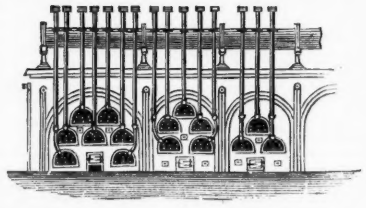
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By

NORTON H. HUMPHRYS, Assoc. M. Inst. C.E., F.C.S.

This work contains chapters on: The Relative Cost of Light from Gas, Oil, and Candles; Products of Combustion; The Sulphur Question; The Composition of Illuminating Gas; Water Gas; Various Gas-Making Processes; Oil Gas; Properties of Fluid Hydrocarbons; Tar for Gas-Making; Destructive Distillation; Condensation; and Purification.

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Compiled and arranged by **ALFRED LASS,** Fellow of the Institute of Chartered Accountants.

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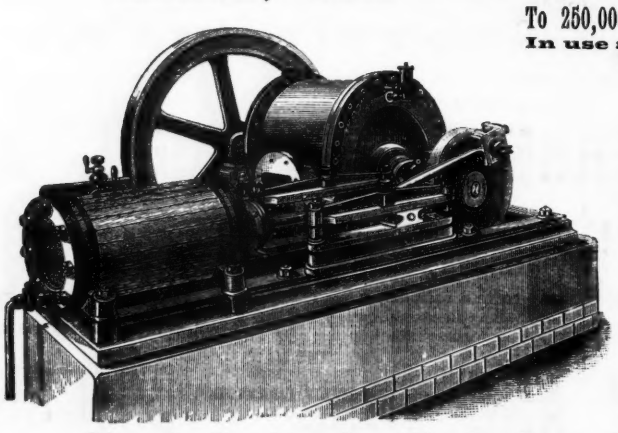

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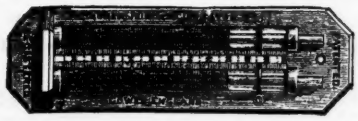

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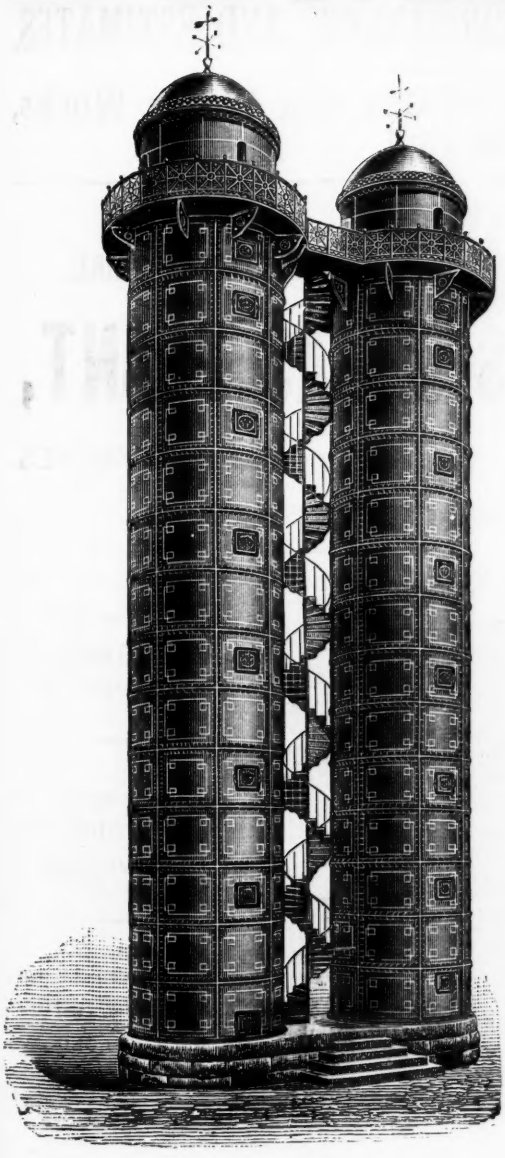

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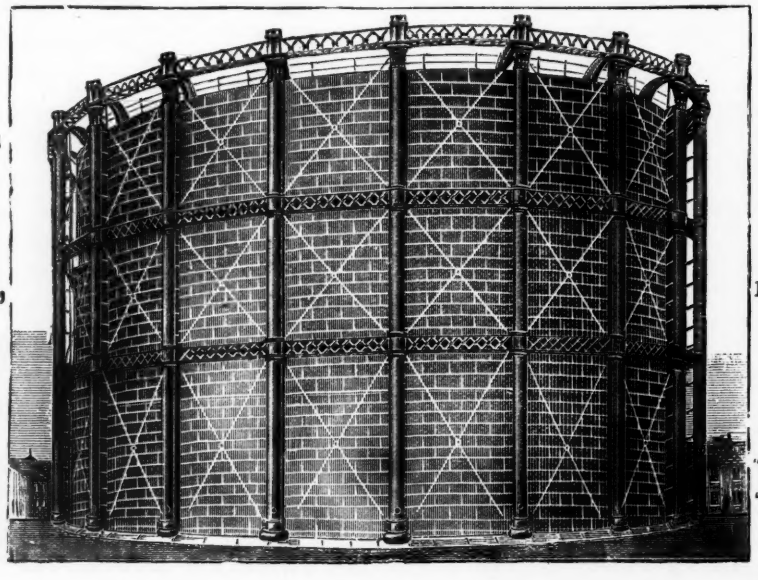

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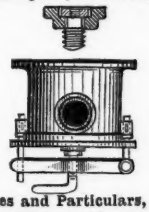

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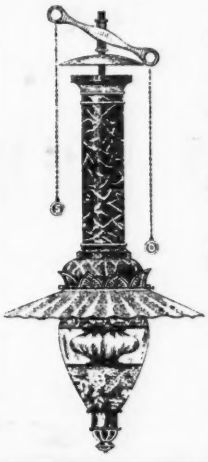

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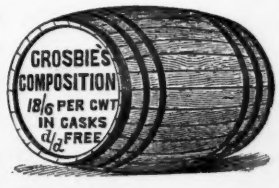

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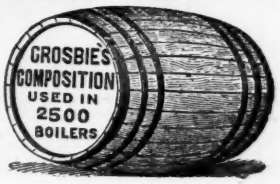
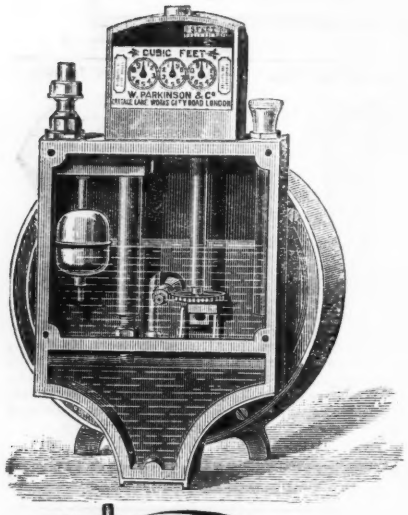


W. PARKINSON & Co.

— ESTABLISHED 1816 —

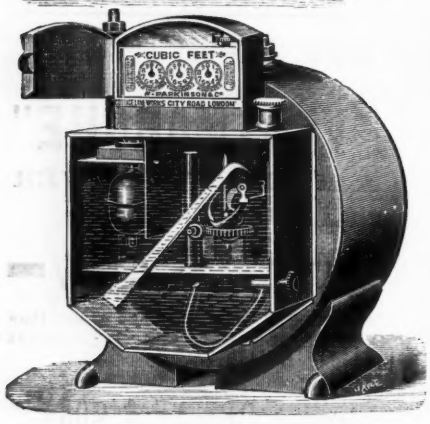
THE ORIGINAL MANUFACTURERS OF WET METERS.



ORDINARY WET METERS

IN CAST-IRON CASES.

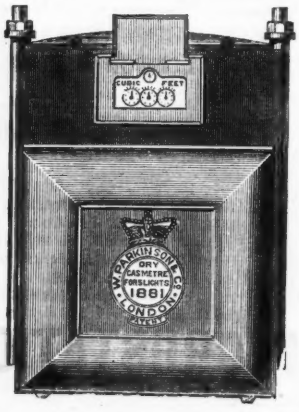
Work with very little friction. Will stand very high pressures. Cannot possibly be shut off by sudden increase of pressure, the Float being affected by Outlet Gas only. Allow for loss of water by evaporation without materially affecting the registration or shutting off the gas. Unexcelled for simplicity of construction, excellence of workmanship, or accuracy in registration.



COMPENSATING METERS

IN TINNED OR CAST-IRON CASES.

The Slow-Spoon Compensator has been in extensive use for many years; it maintains an unvarying water-line without appreciable friction, and provides a large reserve of water. The Float arrangement allows sudden or excessive pressure on the Inlet without affecting the working of the Meter or extinguishing the Lights.



DRY METERS.

These Meters are unsurpassed for accuracy of registration. The cases are made of the best Charcoal Tin Plates; and each part of the Meter is stamped by special Machinery to ensure uniformity and exactness in construction. The Diaphragms are all of the best Persian Sheep Skins, carefully selected and the brasswork and smaller fittings are of superior workmanship.

COTTAGE LANE WORKS, CITY ROAD,
LONDON.
Telegraphic Address: "INDEX."

BELL BARN ROAD WORKS,
BIRMINGHAM.
Telegraphic Address: "GAS-METERS."

10, MAWSON'S CHAMBERS, DEANSGATE,
MANCHESTER.
Telegraphic Address: "PRECISION."

[See also Advt. p. 672

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